EMPLOYEE PERCEPTIONS TOWARDS GREEN SUPPLY CHAIN MANAGEMENT IN GAUTENG STARCH AND GLUCOSE PROCESSING INDUSTRIES

By

KHETHOKUHLE ANTOINETTE SITHOLE

For the Degree

MSc ENVIRONMENTAL MANAGEMENT

In the

COLLEGE OF AGRICULTURE AND ENVIRONMENTAL SCIENCES

UNIVERSITY OF SOUTH AFRICA

Student number: 41894596

Date: August 2019

Supervisor: Dr LS Mudau

Contact number: 082 045 3574

Work: 011 876 0464

E-mail: antoinette.sithole@gmail.com

ABSTRACT

Supply chains incorporate “green” principles in their processes to promote environmental sustainability. Through an online survey, this study investigated green supply chain management (GSCM) implementation and employee awareness of GSCM initiatives in five starch and glucose processing companies in Gauteng. Eighty employees working in management and supervisory positions participated in the study by completing an online questionnaire. The research findings indicated that employees are aware of environmental goals and targets, environmental policies, legislation and standards, and green designing initiatives implemented. Employees perceive that collaboration with suppliers and contractors on environmental issues is in place, however, government partnerships are perceived as being insufficient. Benefits of green marketing campaigns and GSCM initiatives have not been identified. The study noted resistance to change, lack of adoption of technology advancement, insufficient communication and training, and cost implications as barriers hindering GSCM success. It is, therefore, recommended that appropriate support and communication regarding GSCM initiatives are strengthened.

Keywords: Green supply chain management; Environmental impacts; Environmental sustainability; Environmental awareness; Food manufacturing industry; Green design; Green manufacturing; Green marketing campaigns; Climate change

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GSCM	Green Supply Chain Management
SCM	Supply Chain Management
SA	South Africa
GP	Gauteng province
NGO	Non-governmental organisation
FMCG	Fast-moving consumer goods
GHG	Greenhouse gases
WMO	World Meteorological Organisation
UNEP	United Nations Environment Programme
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
GDP	Gross Domestic Product
CSR	Corporate Social Responsibility
CDP	Carbon Disclosure Project
SLA	Service Level Agreement
CFCs	Chlorofluorocarbons
NEMA	National Environmental Management Act
MDGs	Millennium Development Goals
TQEM	Total Quality Environmental Management
MRF	Material Recovery Facility
SD	Standard Deviation

DECLARATION

I declare that '*Employee perceptions towards green supply chain management in Gauteng starch and glucose processing industries,'* is my own work, and that all the sources I have used or quoted have been indicated and acknowledged by means of complete references.

I further declare that I submitted the dissertation to originality checking software. The result summary is attached.

I further declare that I have not previously submitted this work, or part of it, for examination at UNISA for another qualification, or at any other higher education institution.

Signature: 

Date: 25.09.2019

DEDICATION AND ACKNOWLEDGEMENTS

This study is dedicated to my mother, Ms Nomvula Malambe, and my sister, Miss Ntombifuthi Sithole. Thank you for your support, motivation and for believing in me, I would not have done it without you. You are the best.

Thank you to my supervisor, Dr LS Mudau, for the guidance, valuable input, recommendations and information she offered so that I follow the right channels to complete this project.

Thank you to all the participating companies and employees for their time and contributions.

Above all, thank you to the Almighty God for the ability and all the strength.

CHAPTER 1

INTRODUCTION AND BACKGROUND TO THE STUDY

1.1. Introduction

The incorporation of “green” processing principles in company supply chains has been growing in the manufacturing industry over the years to reduce industry environmental impact (Chin, Tat, & Sulainman, 2015). This worldwide drive to address issues of environmental sustainability is accelerating due to the high levels of environmental pollution, climate change and resource scarcity. Carbon emissions, surplus waste materials, unused toxic materials, traffic congestion and other types of industrial pollution, resulting from the activities of manufacturing companies, can cause considerable harm to the environment (Chin *et al.,* 2015; Laari, 2016; UNEP, 2010;).

This rise in the levels of pollution, climate change and resource scarcity have a negative impact on the survival of humanity, animals and plants (UNEP, 2010). The food manufacturing industry presents a serious threat to the environment. Approximately 19% - 29% of global emissions of greenhouse gases (GHG) are attributed to agriculture and food manufacturing (Vermeulen, Campbell, & Ingram, 2012). It is also mentioned that the major challenge of the 21st century is to increase agricultural production while minimising environmental impact (Global Food Security, 2015). Environmental sustainability therefore brings about hope for the planet to continue being a place where humans, animals, minerals and other resources can be sustained in the physical environment (Banerjee & Shastri, 2010; Viana & Intravia, 2016).

To address environmental problems, the global government, non-governmental organisations (NGOs) and other concerned parties, such as investors, have collaborated and come up with policies and strategies that will pressurise all relevant stakeholders to consider the environment when performing their activities (Kolk & Pinkse 2010; UNDP, 2016). In the 1980s, climate change was made popular in politics by organisations such as the World Meteorological Organisation (WMO) and the United Nations Environment

Programme (UNEP), resulting in the global climate change initiative (Bulkeley & Broto, 2013). Subsequently, in an effort to be globally relevant and meet their environmental sustainability obligations, the South African government has also transformed by putting in place stringent policies and strategies aimed at responding to the environmental challenges and economic instability (Odeku & Meyer, 2010). Hence, the South African food industry should comply with these environmental policies.

It is due to these pressures from the global government, NGOs and other concerned stakeholders that food-manufacturing industries implement green supply chain management (GSCM) (Beske, Land, & Seuring, 2014). Tay, Rahman, Aziz and Sidek (2015) indicate it is through pressure to comply with the law that companies implement GSCM. Brik, Mellahi, and Rettab (2013) also mention compliance with regulations as the most regularly cited external factor that drives manufacturing companies to implement GSCM. Moreover, globalisation, technology advancement, social media and the availability of information have made consumers more knowledgeable about issues of saving the environment (Cone Communications, 2013). Consequently, consumers expect food-manufacturing companies to play their role and address social and environmental issues (Beske *et al,* 2014).

Research conducted in 10 of the biggest countries in the world by Gross Domestic Product (GDP), including the United States, the United Kingdom, Canada, Brazil, France, Germany, Russia, China, India and Japan, has indicated that when consumers are buying products or services they consider Corporate Social Responsibility (CSR) in a variety of their decisions (Cone Communications, 2013). Therefore, according to Cone Communications (2013), 91% of consumers believe that companies must go further than the minimum standards required by regulations to operate responsibly. Meanwhile, 93% consumers prefer more of the products and services that support CSR, thus environmental sustainability becomes part of companies CSR strategies. This environmental consideration from customers also adds pressure to companies to implement GSCM practices within their product or service value chains (Tay *et al.,* 2015).

Other factors that drive companies to focus on the environment are the benefits that come with being “environmentally friendly.” Analysis of sustainability reports that were released by Fortune Global 500 (2009) companies demonstrated that globally, over two-thirds of

the large companies are steadily turning their attention to potential environmental gains in the global supply chain. The reports indicated companies are taking into consideration the economic benefits that can be obtained from both environmental responsibility and cost saving measures (Wu, Dunn, & Forman, 2012). Apparently, consumer demands, competitive advantage and environmental legislation have become the major drivers forcing participants in the industrial sphere to implement GSCM (Brik *et al.,* 2013). These pressures have driven the food-manufacturing industry specifically to be an example of a business whose operations have dynamically progressed to respond to the call to reduce environmental risks and impact (Beske *et al.,* 2014). Thus, GSCM has become one of the important ways for food-manufacturing companies to ensure environmental, social and economic sustainability (Diab, Al-Bourini & Abu-Rumman, 2015).

GSCM is defined as the "integration of environmental thinking into supply-chain management, including product design, material sourcing and selection, manufacturing processes, delivery of the final product as well as end-of-life management of the product after its useful life" (Srivastava, 2007, p.54). This means that in the entire "life-cycle" of a product (from design to consumer to disposal or recycling) there must be an evaluation of environmental impacts presented by the activities in the supply chain, then managing those impacts to ensure there is no harm to the environment (Vercalsteren, Dils, & Boonen, 2012).

The main principle of GSCM is the reduction of waste that includes harmful substances, carbon emissions and energy and solid waste produced by the activities of supply chains. These activities include product invention, raw material sourcing and selection, production process, transporting of final product, end-of-life management of the product and increasing efficiencies (Ghobakhloo, Tang, Zulkifli, & Ariffin, 2013; Sood, 2011). According to Luthra, Kumar and Haleem (2011), GSCM takes into consideration the environmental aspect of supply chain activities and the economical aspect as important objectives, while the conventional Supply Chain Management (SCM) usually focuses on profits as the most important objective.

The scholars further allude that GSCM is "green," integrated and ecologically enhanced, while conventional SCM does not take into consideration environmental aspects and impacts. In conventional SCM, the focus is more on optimum final product manufacturing,

no matter how detrimental its effects are to the environment throughout production and supply; green supply chain recognises the harmful environmental impacts of supply chain processes within supply chain activities (Luthra *et al.,* 2011). For GSCM initiatives to be successfully implemented in the food industry employee involvement plays a critical role (Toke, Gupta & Dandekar, 2012), however this depends on the role and initiative of management and supervisors.

Therefore, it is the purpose of this research to assess the roles of management and supervisors in different departments of five starch and glucose processing companies in Gauteng province, South Africa, to make an analysis on their perceptions towards GSCM practices implemented in their organisations. Manufacturers of starch in South Africa process more than 600 000 tons of maize per annum by separating the maize kernel through a wet milling process to convert it into starch and glucose foodstuffs. Starch and glucose products are used as ingredients for various foodstuffs, beverages and other industrial products (Scheltema *et al*., 2015). The study also determines the level of awareness and involvement of employees in the GSCM initiatives adopted, evaluates if the employees recognise the benefits of green marketing campaigns and GSCM initiatives within their companies, and lastly, identifies barriers hindering the effectiveness of GSCM implementation.

1.2. Scope of the study

To achieve the main purpose of the study, this research assesses the key drivers to GSCM implementation, the environmental impact of the South African starch and glucose processing industry, GSCM initiatives in South Africa, GSCM initiatives implemented in industry, challenges in implementing effective GSCM, and employee perceptions towards GSCM. GSCM practices covered herein are implementation of environmental policies, legislation and environmental management standards; green procurement, partnerships with suppliers, contractors and the government; green designing; environmental risk impact assessment; employee involvement, training and awareness; environmental performance reporting; environmental labelling/eco-branding; green marketing. Respondents in this study are within the rank of supervisory to middle management within the starch and glucose processing industry.

1.3. Purpose of study

The main purpose of this study is to make analysis on the perceptions of employees in the starch and glucose processing industry towards GSCM practices implemented in their organisations to address environmental sustainability, and the level of involvement and awareness of the employees on these initiatives.

1.4. Research sub-objectives

1.4.1. To evaluate the level of employee awareness of environmental policies, legislation, standards, environmental goals and targets, and green designing initiatives implemented.

1.4.2. To assess the perceptions of the employees towards GSCM partnerships that their companies have implemented with suppliers, contractors, including the government.

1.4.3. To evaluate if the employees recognise the benefits of green marketing campaigns and GSCM initiatives within their companies.

1.4.4. To identify barriers hindering the effectiveness of GSCM implementation.

1.5. Main research question

What are the perceptions and the level of awareness of employees in the starch and glucose processing industry towards GSCM practices implemented in their organisations to address environmental sustainability?

1.6. Research sub-questions

1.6.1. At what level are the employees involved made aware of the environmental policies, legislation, environmental goals and targets, and green designing initiatives implemented?

1.6.2. What are the perceptions of the employees towards company's environmental management partnerships with its suppliers, contractors, including the government?

1.6.3. To what extent do employees recognise the benefits of green marketing campaigns and GSCM initiatives?

1.6.4. What are the barriers that hinder the effective implementation of GSCM?

1.7. Research problem

Starch and glucose processing industries are not only faced with striving to be socially and economically sustainable, but are compelled to address environmental sustainability by implementing various successful GSCM initiatives (Diab *et al*., 2015). The rise in GSCM implementation is driven by the urgent need to address environmental pollution, ozone depletion, climate change and resource scarcity, which are current threats to the sustainability of the environment. As a result, companies are motivated to take up GSCM practices when they are pressurised by various stakeholders, such as governments, customers, competitors, society and NGOs, and when they are certain that GSCM will positively influence their competitiveness and reduce their environmental impact (Vanpoucke, 2014).

The challenge however, is that organisations fail to adopt and successfully implement GSCM practices due to the lack of systematic approach to the application of GSCM initiatives and lack of employee involvement, which leads to wasted effort and costs (Kudroli, 2014; Luthra *et al.,* 2011). For a systematic "closed-loop oriented" approach to GSCM, studies outlined that the concepts and strategies to be considered are improved environmental policies, green product design, green procurement, green material management, green manufacturing process, green marketing and distribution, and reverse logistics (Liu & Chang, 2017).

One of the critical success factors that drives an effective GSCM strategy is employee involvement, hence top management must fully commit to GSCM and support, train and reward employees who perform outstandingly toward green initiatives (Luthra *et al.,* 2011; Toke *et al.,* 2012).

1.8. Research design

The research design of this study is descriptive quantitative method. A survey was used to explore the perceptions of starch and glucose processing industry employees towards GSCM. Leedy and Ormrod (2010) describe quantitative survey research as a method that involves discovering people's opinions towards a subject by asking them questions and tabulating their responses. It provides a quantitative explanation of trends, viewpoints, or opinions of respondents by studying a sample of the population (Creswell, 2014).

The instrument chosen to collect data for the study was a structured closed-ended questionnaire, as it is considered one of the effective methods of gathering data on an extensive scale. The advantage of questionnaires is that they can be sent simultaneously to many respondents, and anonymity enables information to be shared by the respondents without difficulty (Zohrabi, 2013).

1.9. Justification of the study

GSCM continues to be the subject that receives immense attention from academics and companies over the years. Most companies are going green due to pressure to fulfil environmental legislation obligations, pressure from consumer demands and to increase environmental performance (Niemann, Kotze, & Adamo, 2016).

Although, many researchers continue to study GSCM, there are still limited studies conducted to investigate GSCM adoption and implementation in the food industry within developing countries. This was revealed in a study conducted by Seman, Zakuan, Jusoh,

and Shoki (2012), whereby they reviewed the development of GSCM in developed and developing countries. The study indicated a lack of research to evaluate the adoption and implementation of GSCM practices, particularly in developing countries, and suggested more studies should be conducted.

The focus of most GSCM studies conducted in South Africa (SA) have been on the Fast-moving consumer goods (FMCG), transport, construction and retail industries. It has been determined, through the maturity assessment of GSCM of the South African FMCG industry by Craggs (2012), that the country's retailers have been successful in being 'green' focused and in applying 'green' sourcing methods. Schoeman and Sanchez (2009) focused on studying GSCM in the grocery retail industry. These researchers further looked at the contributions made by the transport and supply chains to carbon pollutions. Ojo, Mbohwa, and Akinlabi (2013a) did a comparison study of GSCM in the South African and Nigerian construction industries and discovered there have been few GSCM literature reviews on South African construction supply chain, and much has been said about the subject in the country. GSCM is widely spread and practiced informally in the SA economy (Smit & Musango, 2015).

However, there are limited studies on how the employees adopt and implement GSCM in food industries. The approach of this study therefore is to focus more on GSCM in the food manufacturing industry in Gauteng province, South Africa, particularly the companies that process starch and glucose to manufacture products for human consumption.

The study intends to determine employee awareness and involvement in the different GSCM practices applied in their organisations to address environmental sustainability. It explores the perceptions of employees in this industry towards the GSCM initiatives implemented in their companies by getting the employees in different departments to participate in a survey.

1.10. Significance of the study

The survey of employee perceptions towards green supply chain management in the Gauteng starch and glucose processing industry is significant because it provides numerous contributions to the body of knowledge. Seman *et als.* (2012), study revealed the lack of research to evaluate the adoption and implementation of GSCM practices in developing countries and suggested more studies on GSCM in developing countries should be conducted. Therefore, it is partly for this reason that this study firstly, provides more information to researchers on the contribution made by the food-manufacturing industry in addressing environmental sustainability issues, and contributes to the increase of empirical evidence of the adoption and implementation of GSCM practices in developing countries.

Secondly, the research makes GSCM adoption and implementation more transparent in South Africa, encouraging the government to play a supportive role to the success of industry greening initiatives, which in turn assists the country with achieving environmental goals.

Thirdly, the study may further assist companies to make informed decisions on their GSCM implementation endeavours by providing the complete framework to an effective approach to successful green strategies.

Lastly, top management in food companies can learn how employees perceive GSCM implemented in their businesses to be able to steer them in the right direction to achieve successful “green” organisational goals.

1.11. Limitations to the study

The study has various limitations:-

Firstly, the study was limited to only five targeted food companies that process starch and glucose used for the manufacture of food and beverages for human consumption. Manufacturing processes involve supplier sourcing, procurement of raw materials, processing of raw materials to produce starch and glucose, transportation of the starch and glucose, further processing to manufacture food products, and transportation to the

consumer. Hence, the study outcomes cannot be generalised to conclusive assumptions about employee perceptions towards GSCM in the food-manufacturing industry, but the information is vital for use to inform employers on what needs to be improved to make it successful.

Secondly, this research was geographically limited to Gauteng province, SA, (Figure 1.1) due to lack of funds. The sample size was also small due to time and resource constraints. Researchers with sufficient budget and time can expand the research to more manufacturing industries and more provinces in the country.

Figure 1.1. Map of Gauteng province (Source: Department of Water & Sanitation, 2019)

Thirdly, distribution of the questionnaire was a challenge as it took some time to obtain company approvals for the research and email information for the target respondents. The sample size was 150 respondents with a response rate at 53%. The challenge was overcome by repeated follow-up through email and telephone calls to encourage

respondents to respond. Nevertheless, the sample size was sufficient for the research and the obtained response rate was good considering other similar GSCM online studies.

Kora (2016) sampled 41 employees in managerial positions, responsible directly or indirectly for the supply chain activities of a company to investigate GSCM practices and organisational performance in Ethiopia; 36 questionnaires were correctly filled and applied in the study, producing a response rate of 88%. Bai (2011) investigated the development of environmental management in the New Zealand food industry using 60 on-line questionnaires circulated to managers or directors; 28 questionnaires were returned, giving a 46% response rate. In contrast, Green, Zelbst, Meacham and Bhadauria (2012) used a sample size of 159 managers in manufacturing industries in the United States to evaluate the impact of implementing GSCM practices on environmental, operational and organisational performance, with a response rate of 8%.

Lastly, employees in managerial and supervisory roles in the departments of procurement, logistics, processing/production, engineering/maintenance and Safety, Health, Environment and Quality (SHEQ) were considered for this research. Future researchers could consider studying the design and development department to establish, in depth, the extent at which food companies have considered green product designing in terms of Life Cycle Assessment (LCA) and Environmentally Conscious Design (ECD). Future research can also be done targeting employees in various positions to uncover how they perceive GSCM implementation in their companies.

1.12. Delimitations

Delimitation is indicating what the researcher is not going to do in the study (Leedy & Ormrod, 2010). Delimiting the study serves to ensure the research undertaken is not too wide and therefore is manageable and accurate to complete. The study did not go beyond the starch and glucose processing companies in Gauteng province of South Africa.

1.13. Validity and reliability

Creswell (2014) suggests a survey should be piloted or field-tested so that rationale for using the instrument is substantiated. It is vital to test the survey to determine the content validity of scores on the survey and to improve questions, layout, and scales. A pilot study was conducted to test the validity and reliability of the survey questionnaire and the instrument of measurement, which was the Likert Scale. Details of the pilot study are outlined in section 3.5.

1.14. Chapter layout

1.14.1. Chapter 1 (Introduction and background to the study)

This chapter is the introduction and background to the study. It outlines the introduction, scope of the study, purpose of the study, research sub-objectives, main research question, research sub-questions, the research problem, research design, motivation of the study, significance of the study, limitations, delimitations, validity, reliability and the structural plan of the final report.

1.14.2. Chapter 2 (Literature review)

This chapter is the literature review, which is the continuation of Chapter 1. More research on the key drivers to implementing GSCM, GSCM initiatives implemented in industry, GSCM initiatives in South Africa, the Gauteng starch and glucose processing industry and its impact on the environment, employee perceptions towards GSCM, and challenges in implementing effective GSCM are outlined. This information is linked to the objectives of the study, the research and the topic.

1.14.3. Chapter 3 (Research methodology)

In this chapter, the research methodology is discussed. The structure of the questionnaire is outlined, and respondents are determined. The questionnaire is constructed from the objectives and literature relating to GSCM initiatives implemented in the starch and

glucose processing industry. Discussions of the types of statistical and inferential analyses considered, limitations, delimitations, pilot study and ethical considerations are also expanded. This section also outlines the rationale behind the chosen research design.

1.14.4. Chapter 4 (Analyses, results and discussion)

In this chapter, the results, interpretation and discussion are outlined. The analysis is completed, and explained, using descriptive statistical methods to determine the frequencies, percentages, means, standard deviations (SD), and p-values of 0.05 at 95% confidence level using the Kruskal-Wallis test and *t* tests. This chapter concludes with the outcome of the study, revealing the perceptions of employees in the starch and glucose processing industry towards GSCM initiatives implemented in their companies. The awareness and involvement of employees in the different GSCM practices applied in their organisations to address environmental sustainability is determined.

1.14.5. Chapter 5 (Conclusion and recommendations)

This chapter is the conclusion of the research. It consists of the discussion of the research findings, summary on research objectives and questions, recommendations for future research and conclusion.

CHAPTER 2

LITERATURE REVIEW

2.1. Introduction

The purpose of this chapter is to review further literature related to GSCM and highlight some of the key factors that drive organisations to implement GSCM programmes. In section 2.2, the key drivers to GSCM implementation are provided while the environmental impacts of the South African starch and glucose processing industry are examined in section 2.3. Furthermore, the importance of the GSCM is contextualised in section 2.4. Section 2.5 is based on GSCM initiatives and the challenges in implementing effective GSCM and employee perceptions are interrogated in section 2.6 and section 2.7, respectively. Lastly, a brief summary of the literature reviewed is given in section 2.8 whereby key findings are outlined meanwhile literature gaps are indicated.

2.2. Key drivers to GSCM implementation

2.2.1. Environmental impact

The implementation of GSCM is mainly driven by the need for supply chains to urgently address the environmental challenges faced by planet Earth. Wimmer, Lee and Quella (2010), classify the environmental challenges into three broad categories namely, direct environmental problems, indirect environmental problems and resource mismanagement problems. Direct environmental problems or “end of pipe” pollution type problems are oil spills and raw sewage release. Indirect environmental problems are those that have unintentional consequences or unexpected effects resulting from designed activities. For example, pesticide development and use, which impact on the reproductive capability of waterfowl, sulphur and nitrogen oxide discharges from industrial activity causing acidification of lakes and soils. These activities cause imbalance of the nutrient content of surface water, the radiation balance of the atmosphere, concentrations of trace materials in food chains. They also cause ozone depletion from releases of

chlorofluorocarbons (CFCs) and climate change, which arises from release of greenhouse gases (Wimmer, Lee, & Quella, 2010). Resource mismanagement problems, such as poor forest management activities and over-consumption of certain metals that result in scarcity, net resource depletion and species and habitat loss (Wimmer, Lee, & Quella, 2010), are undesirable by-products of increased economic activities referred to as environmental impacts (UNEP, 2010). Thus, GSCM is implemented to reduce the environmental impact of manufacturing companies.

According to Dietz and O'Neill (2014), these categories of environmental impacts are caused by economic growth. There has been an increase in industrial activity to meet the increasing demand for resources by the growing world population (Attah, 2010). Expansion of the economy results in more consumption of materials and energy, and emission of more wastes. The core problem with pursuing never-ending growth emanates from the fact that the economy is a sub-system of the biosphere. Due to growth of GDP, humanity now uses eleven times as much energy, and eight times the weight of material resources every year compared to a century ago (Figure 2.1). Therefore, it is not the exchange of money that impacts the ecosystems but the flow of materials and energy because of the increase in supply chain activities that consume a lot of energy and minerals and release waste (Dietz & O'Neill, 2014).

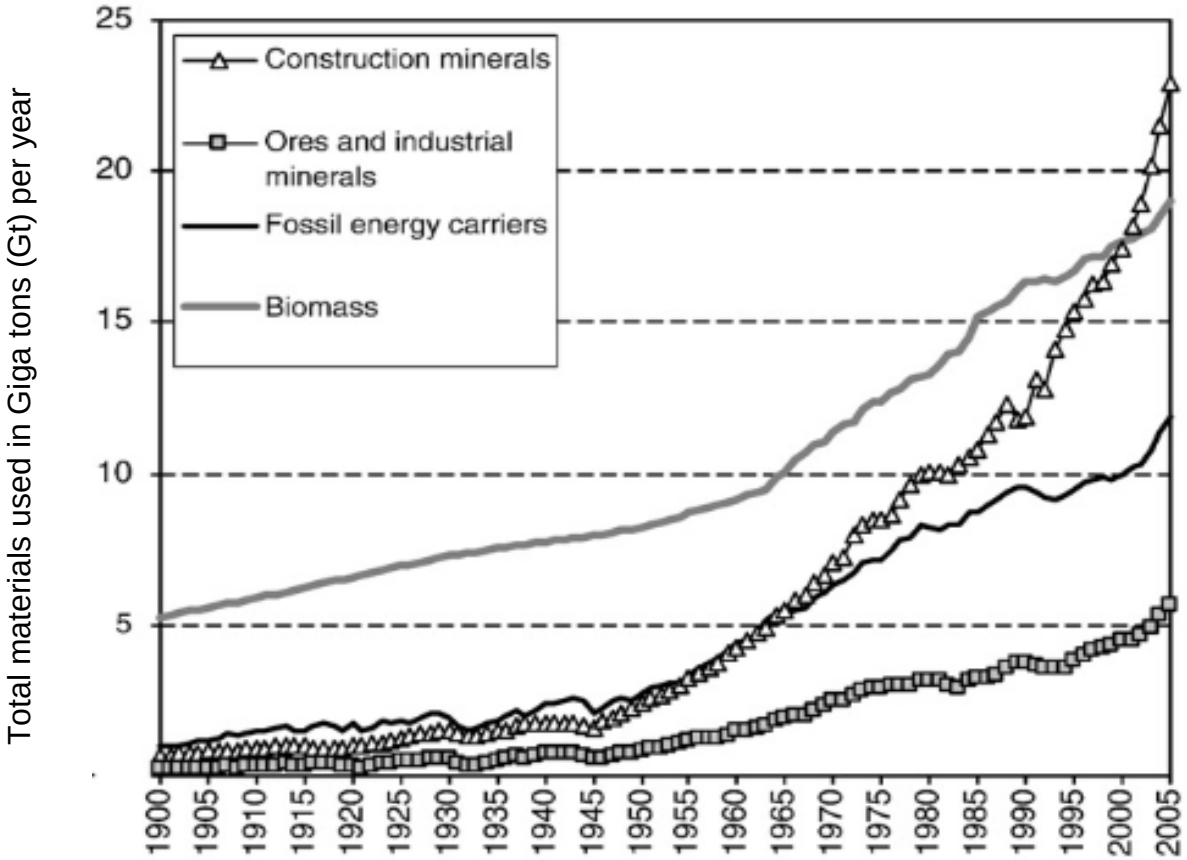

Figure 2.1. Humanity's use of materials (Source: Krausmann *et al*., 2009, p.8).

Climate change, which can be defined as the shift of weather conditions over time, is an indirect environmental challenge in which governments together with all relevant stakeholders, including manufacturing industries, are putting effort into to mitigate (Kolk & Pinkse, 2010). In recent decades, more extreme and unpredictable weather conditions have been experienced globally due to the increase in the average temperature on the planet. The problem is escalating, resulting in some parts of the world getting hotter, some colder, some wetter and others drier. Greenhouse gas emissions are rising more rapidly than predicted and as a result, the world is warming quickly (Claassen *et al.,* 2014; WWF-SA, 2013).

The major cause of climate change is Carbon Dioxide (CO_2) gas, other gases include Methane (CH4), Nitrogen Oxides (NOx), and several synthetic gases,

Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs) and Sulphur Hexafluoride (SF6). Accelerated sea level rise, droughts, floods, storms and heatwaves are some of the disastrous weather patterns caused by global warming. These conditions affect some of the world's most vulnerable and poorest people, because food production is disrupted, and vitally important species, habitats and ecosystems are endangered (WWF-SA, 2013). It is noted that South Africa contributes significantly to global climate change by emitting relatively significant GHG levels due to its energy intensive, fossil fuel driven economy (Department of Environmental Affairs, 2012). Predictions by the Intergovernmental Panel on Climate Change (IPCC) in 2014, state that by 2050, climate change in Southern Africa could escalate from 1°C to 3°C in mean temperatures and this could result in 5 to 10% reduction in rainfall over the summer rainfall region. As a result, these changes will influence the social, economic and natural environment, especially in Gauteng province, South Africa (Claassen *et al.,* 2014).

Contrasting with Dietz and O'Neill's (2014) notion that environmental problems are caused by economic growth, Gauteng is the economic hub of South Africa and according to Claassen *et al.* (2014, p22), climate change in the province is attributed to "high concentration of mining activities (1.8% of the province's total area); high concentration of industries (1.7% of the province's total area); high population density (517 people per km^2); large motor vehicle population (37% of the country's vehicles); high energy consumption by the mining, industrial, transport and residential sectors; and a defined inversion layer during winter months." Thus, GSCM adoption in manufacturing companies in Gauteng province will ensure that emissions contributing to climate change are reduced at a significant rate.

Resource mismanagement problems were mainly driven by the impressive growth rate of the economy over the first decade of the 21st century in developed countries. Therefore, demand for natural resources, such as agricultural goods, water, energy, and minerals, have increased dramatically and on a geographically exceptional scale, this results in larger constraints on the physical supply of these resources (McGill, 2013). Specifically, water has been highlighted as a seriously limited natural resource and it affects economic and social development objectives and the maintenance of ecological systems (Amis & Nel, 2011). In the World Wild Life Fund South Africa's Business Water Risk Report released in 2011, the 2030 Water Resources Group (2009) states that some parts of

South Africa have a steppe climate with rainfall of 420mm, which is less than half the worldwide average. It is said that this geographical variability in rainfall amounts and magnitude, causes some parts of the country to have too much rainfall, which causes floods, and periodic droughts in others (Amis & Nel, 2011). The Water Resource Group (2009) statistics estimated that a gap of around 17% in water demand and availability will result by 2030, if there are no considerable policy shifts. Within freshwater reservoirs in South Africa the projection is that by 2030 the gap from source and demand might range between 20 to 50% (Amis & Nel, 2011).

It has also been highlighted in the Gauteng Provincial Environmental Management Framework report that water is a natural resource that is depleting in Gauteng due to its dense population and high concentration of economic activities (Claassen *et al*., 2014). Furthermore, it is mentioned that the province is situated in a water-stressed area in the middle of the Orange/Vaal and the Crocodile/Limpopo river systems. This region has limited natural water resources with rainfall that is reasonably low and vastly seasonal and variable (Gauteng Provincial Government Planning Division, 2015). Thus, without water in this province sustainable agriculture will not be possible and therefore there will be a shortage of raw materials for the food industry. GSCM in food industries ensures the reduction of water usage, in turn ensuring sustainable food. GSCM practices in manufacturing companies assists with the reduction of water consumption (Younis, 2016)

Direct pollution of the natural environment is caused by various economic activities whereby solid and chemical wastes are released into the environment. These wastes contaminate the soil, surface water and ground due to poor and ineffective management of landfills, ineffective environmental law enforcement and inappropriate waste treatment. This pollution can also become a source of health hazards amongst communities living in such areas (Sankoh, Yan, & Tran, 2013). The natural river systems in GP (Gauteng province) also suffer from unacceptably high levels of pollution due to insufficient waste management as well as erosion and excessive sedimentation, in some parts due to urban growth (Gauteng Provincial Government Planning Division, 2015). GSCM adoption in GP ensures that companies reduce their environmental impact by preventing solid and chemical waste being disposed into the environment (Sood, 2011).

2.2.2. Response to governments, NGOs and consumer demands

As stated above, GSCM adoption in industry results from the need to resolve environmental impacts and to save the planet. Global governments, NGOs and other stakeholders, such as investors and civil society, are giving more attention to the environment (Fiksel, Lambert, Artman, Harris, & Hugh, 2004), hence policies and stringent environmental laws have emerged and are being enforced (Kolk & Pinkse, 2010; Odeku & Meyer, 2010). Approximately 189 nations have adopted the international policy on climate change, which was established with the implementation of the United Nations Framework Convention on Climate Change (UNFCCC) at the United Nations Conference on Environment and Development, in Rio de Janeiro in 1992 (Kolk & Pinkse, 2010). The purpose of the policy was to alleviate greenhouse gas concentrations in the atmosphere at a level that would prevent “dangerous anthropogenic interference with the climate system” (UNFCCC, 1992).

It was not long after Rio de Janeiro that other conventions followed, such as Kyoto, Japan in 1997, Copenhagen, Denmark in 2009 (Attah, 2010) and COP 17, Durban in 2011. The attention brought about by COP 17 ensures that the South African Government actively implements a wide range of Climate Change related initiatives as per the Copenhagen treaty, where South Africa committed that by 2025 it will achieve a 42% reduction in emissions (Wolpe & Reddy, 2015). The commitment of South Africa to its climate change response is guided by the principles outlined in the Constitution of 1996, the Bill of Rights, the National Environmental Management Act 107 of 1998 (NEMA), the Sustainable Development Goals (SDGs) of 2030 and the UNFCCC 1992 (Wolpe & Reddy, 2015; UNDP, 2015).

It is therefore required that organisations and economic sectors or sub-sectors that emit GHGs above set limits put mitigation plans in place to reduce emissions to acceptable levels (Department of Environmental Affairs, 2012). Winstanley (2009) indicated that notices and directives are issued by the government to bring to an end to illegal operations that pose dangerous environmental effects, fostering compliance, and/or imposing control measures to avoid, remediate or alleviate harm. Consequently, it is in

response to governments and NGO demands that many organisations have implemented GSCM. Research has found it is primarily for the reasons to avoid verbal and written warnings, penalties, court cases, legal liability claims, criminal prosecution and major reputation erosion brought about non-compliance with legislation and regulations that companies pursue GSCM (Laosirihongthonga, Tanb, & Adebanjoc, 2013). Brik *et al.* (2013) and Tay *et al.* (2015) highlighted the pressures to comply with the law that companies implement GSCM.

Significantly, it is also external factors, such as country export regulations and pressure from head offices of manufacturing companies, which compel organisations to pursue greening initiatives. Although current country-specific mandatory policies effectively enhance companies' GSCM practices, the spread of GSCM practices is normally more international market-driven (Liu, Wang, Dong, Yang, & Bao, 2011). Studies indicated that local government regulations, competitors and customers are not the only drivers to GSCM implementation, the two external factors mentioned above are also connected to supply chains greening their activities. These factors do not originate from countries where companies operate but from foreign countries. There are strict environmental regulations that emerging nations must comply with, especially when exporting to major markets such as the United States and the European Union. Multinational and foreign-funded companies have more active GSCM practices than domestic ones (Brik *et al.,* 2013; Wu *et al*., 2012).

There is also high awareness of environmental issues by consumers, leading to the demand for more environmentally friendly products (Cone Communications*,* 2013). Due to trade globalisation, regulations and standards are progressively shifting from "buyer beware" to focusing on decreasing a product's potentially harmful impact throughout all aspects of its lifecycle (Beske *et al*., 20142014). These are referred to as "institutional pressures" that persuade companies to implement GSCM to improve their environmental performance (Masoumik, Abdul-Rashid, Olugu, & Ghazilla, 2015). Tay *et al.* (2015) list customers as external influencers to GSCM implementation, as large customers may drive smaller suppliers to take up GSCM. The adoption of GSCM practices was driven by customer pressures in Kenyan manufacturing companies (Mwirigi, 2016), and Laari's (2016) study found customer requirements for environmental sustainability was an important factor, resulting in the implementation of GSCM. Furthermore, the results of a

study by Rahman, Ho and Rusli (2014) revealed that customers are an external pressure that drive Malaysian manufacturing companies to adopt GSCM.

2.2.3. Financial benefits

Another factor that compels businesses to implement GSCM is the financial benefits that come with it, which often contribute to business success. Effectively implemented, GSCM initiatives can have a positive impact on environmental, operational and financial performance. Hence some companies have already taken advantage of the potential environmental and financial benefits in the global supply chain that can be obtained from such initiatives (Eirini *et al*., 2013; Gardas & Narkhede, 2013; Wu *et al*., 2012). According to Gardas and Narkhede (2013), GSCM is no longer just a buzz phrase, but an important strategy that companies can utilise to leverage benefits in efficiencies, competitive advantage, in a business bottom line and savings in resources and energy.

Rahman *et al*. (2014) indicate that GSCM initiatives alleviate the environmental impact of the manufacturing activities within organisations without negatively affecting product quality, cost, reliability, performance or efficiency of energy utilisation. Emissions, hazardous materials and waste are reduced. Energy efficiency measures taken by companies reduce energy consumption. Recycling and reusing ensures that scarce resources are managed well to prevent over-consumption, net resource depletion, and species and habitat loss (Rahman *et al.,* 2014). Hence, Tsoulfas and Pappis (2006) encourage manufacturing companies to replace non-renewable and polluting technologies with renewable energy resources and pollution prevention technologies. These will reduce energy consumption, thereby positively impacting long-term sustainability of a manufacturing company and consequently reducing environmental impact (Tsoulfas & Pappis, 2006).

Businesses that have implemented adequate GSCM practices that include long-term buyer–supplier relationships have simultaneously reduced the environmental impacts of their suppliers and their own manufacturing activities, ensuring direct and indirect environmental problems are eliminated or reduced throughout supply chains (Kumar & Chandrakar, 2012). Consequently, costs will be cut due to not having to pay fines

resulting from violating environmental regulations,and there will be significant savings in manufacturing costs, recycling and reuse of raw materials. Competitive advantage, reputation and brand image of organisations are also enhanced (Diab *et al.*, 2015; Gimenez, Sierra, & Rodon, 2012; Hoskin, 2011; Kudroli, 2014; Testa & Irlado, 2010).

Khan and Qianli (2017) indicated, from the perspective of the Pakistan manufacturing industry, that green manufacturing, green purchasing, green information systems, cooperation with customers and eco-design enhance company performance. Whilst Diab *et al.* (2015) indicated that according to Jordanian Nutrition Industries, internal environmental management, collaboration with customers, green purchasing, eco-design and packaging, have a positive impact on environmental performance, financial performance, and operational performance of organisations. Meanwhile, a study by Younis (2016) found that in the United Arab Emirates (UAE), green purchasing was a key green supply chain practice that improves both operational and economic performance. In the Kenyan automative industry, green procurement, green manufacturing, green distribution and reverse logistics practices were found to be important in improving the performance of firms (Jemutai, 2014). Perceived business benefits have also been highlighted in Kenyan manufacturing companies as a driver to implementing GSCM stategies (Mwirigi, 2016). Furthermore, the empirical results of Laari's (2016) study conducted in Finland, suggested that environmental collaboration with customers was the most effective way to improve financial performance. Thus, the above are concurring with the literature review done by Gardas and Narkhede (2013) stating that GSCM gives companies financial advantage.

According to Huffman and Klein (2013), environmental sustainability in the workplace was the measure of organisational success according to the triple bottom line criteria (people, planet and profit). These are critical factors in an organisation's success, which act individually, and collectively, to maximise effective use of natural resources and minimise negative impact on the planet. People typically include both employees and community, the planet reflects the natural environment, and profit represents traditional shareholders. Companies have adapted to the ability to balance social, environmental and financial needs of the businesses and have reaped tangible financial benefits (Diab *et al*., 2015). They have taken heed of the message of inclusive sustainable development, which is the "green growth" message promoted by Drucker (1974, p.34), as cited by Pullman and

Sauter (2012), which challenges businesses to aspire to convert society's needs into opportunities for profit without compromising the need of future generations.

Pullman and Sauter (2012) cited, "*It is not enough for the business to provide just any economic goods and services; it must provide better and more economic ones. It is not necessary for a business to grow bigger; but it is necessary that it constantly grows better. When the business community measures corporate performance, the concept of the triple bottom line, in which people, planet, and profit (social, environmental, and economic concerns) are of equal importance is used. These three issues are intrinsically interconnected in business, and today they are often discussed under the single rubric of "sustainability."* Consequently, sustainable purchasing and supply are used to reduce negative impacts on the environment, economy and society (Eirini *et al*., 2013; Pullman & Sauter, 2012).

2.3. Environmental impact of the South African starch and glucose processing industry

This section gives an overview of the processing of starch and glucose for the manufacture of food and beverages for human consumption, and the impact of their activities on the environment. Wheat, maize and potatoes are the three crops used as raw materials for the manufacture of starch and glucose (Vercalsteren *et al*., 2012). Maize is used for the manufacture of starch and glucose in SA. Apart from being used as feed grain or staple food of most of the SA population, about 4.8% of the maize stocks in the country are used to produce starch and glucose syrups that are utilised as ingredients in the production of a wide variety of beverages and foodstuffs (Scheltema, Meyer, Delport, & Gxotiwe, 2015). It is mentioned in chapter one that manufacturers of starch in South Africa process more than 600 000 tons of maize per annum by separating the maize kernel through a wet milling process to convert it into starch and glucose foodstuffs (Scheltema *et al.,* 2015). Furthermore, the starch and glucose products are used as ingredients for various foodstuffs, beverages and other industrial products. Numerous activities in the starch processing supply chain have an impact on the environment by using utilities such as water, electricity, gas as energy sources and emitting solid, liquid and gaseous wastes (figure 2.2)


Cradle of raw
material

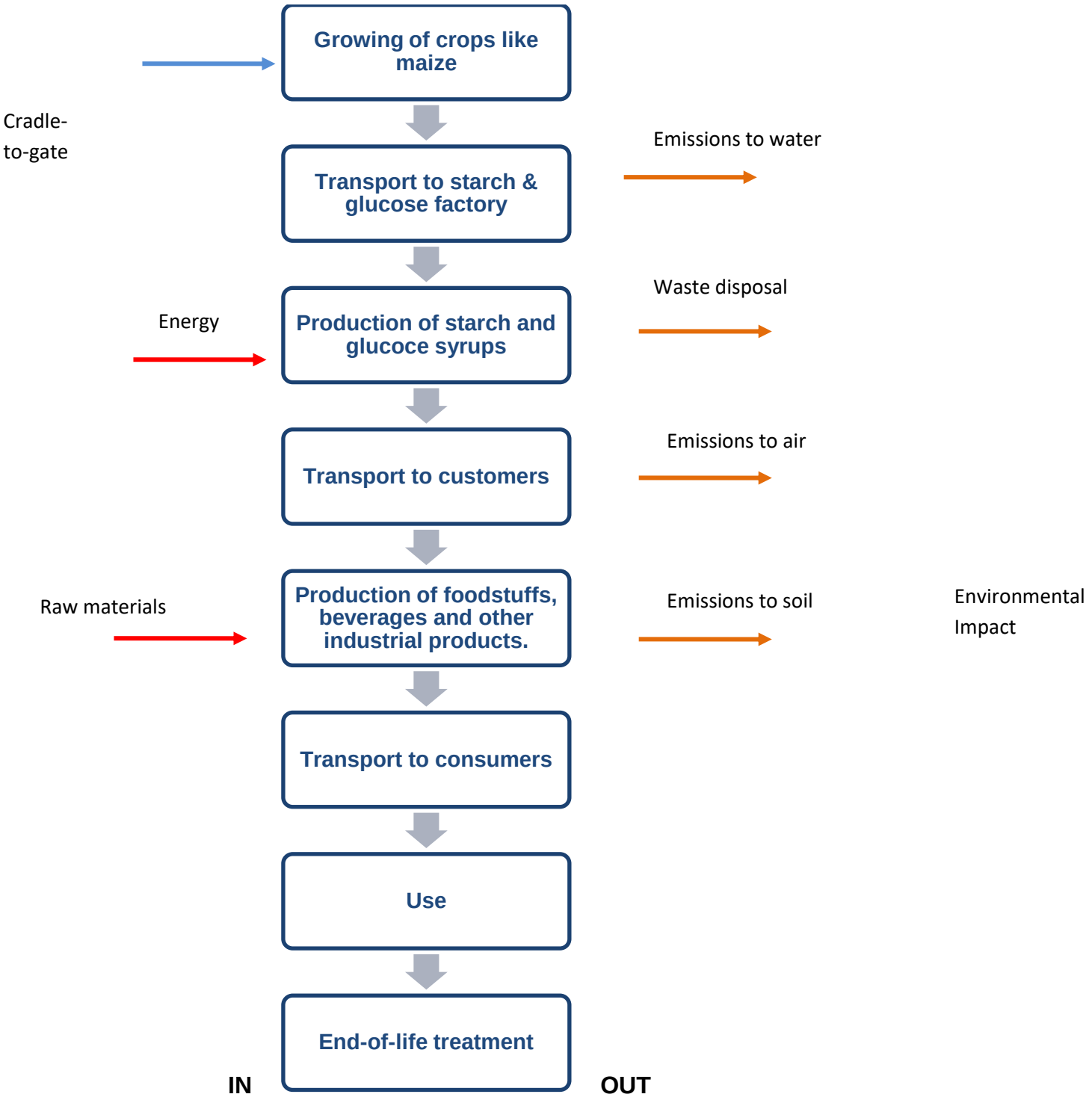

Figure 2.2. Environmental impact of starch & glucose processing (Vercalsteren *et al.*, 2012, p10)

Figure 2.2 indicates the environmental impacts posed by starch and glucose processing as demonstrated in a study by Vercalsteren *et al.* (2012, p10). At the cradle of raw material

stages, the farming of the crops, fertilising, pesticides application, land use and energy and fuel (electricity, heat, fossil fuels) use, make up the largest part of the environmental impact of the final products. According to Vercalsteren *et al.* (2012), agriculture accounts for more than two thirds of the impact for both carbon footprint and water scarcity. Emissions of solid waste, liquid waste and GHGs into the environment occur throughout the stages of starch and glucose processing for food manufacturing. This environmental impact should drive starch and glucose processing industries to implement GSCM practices.

2.4. Green supply chain management in South Africa

The implementation of environmental regulations and policies that focus on sustainable development has resulted in GSCM gaining significant attention in developing countries (Niemann et al., 2016; Tay et al., 2015). Although, the approaches to GSCM are still somewhat new in South Africa, it has been implemented in manufacturing companies and a few construction companies (Ojo *et al.,* 2013a). Ojo *et al.* (2013b) identified in several literature reviews of manufacturing companies that GSCM is not new in the transport and food industries in South Africa. For example, bodies such as The Chartered Institute of Logistics and Transport: South Africa (CILTSA), the Consumer Goods Council of South Africa and Supply Chain Today introduced a Green Supply Chain Awards programme in 2009. The aim of the Green Supply Chain Awards was to recognise and reward companies that were making significant improvement to reduce the environmental impact of their supply chain processes and enthusiastically seeking ways to improve environmental performance (Larkin, 2013).

Green Supply Chain Awards showed that South African supply chains have taken great strides in GSCM initiatives. For example, in 2013, Rainbow Farms won the “Best Project: R1-million to R10-million” category for converting incandescent lighting in 36 facilities to LED systems, significantly reducing electricity utilisation by 117 000 kWh per month. TFD Network Africa won “Best Project over R10-million” category for launching “Driving the Green Movement,” a project they implemented for addressing energy efficiency, water management, waste management and carbon emission minimisation (van Niekerk, 2013). In 2013, Barloworld Logistics, Ellerine Holdings and Growth Point Properties used

green building technologies transforming an abandoned foundry into a state-of-the-art warehouse for green supply. They earned a “Highly Commended” mention during the awards. ECO2Fleet, a web-based reporting service developed by Standard Bank that measures the carbon footprint of a vehicle fleet to minimise costs and to DHL’s aerodynamic teardrop trailer that lessens wind resistance at speed are impressive products that won awards in the “Best Product” category, to mention a few (van Niekerk, 2013).

A study conducted by Smith (2014) also found that South Africa’s largest retailers are doing well in terms of sustainability. Certain JSE-listed retailers (Shoprite, Pick n Pay, Massmart, Spar, and Woolworths) of fast-moving consumer goods, which are household names in South Africa, were analysed by accessing information from company annual reports, public domains, such as websites, and information disclosed in the Carbon Disclosure Project (CDP) and found to be excelling in their sustainability programmes. Interviews were also conducted with sustainability executives of those retailers that agreed to participate. In the study, Pick ‘n Pay and Woolworths were given A-scores in the JSE’s Sustainability Reporting Index (SRI) in 2011, which indicated they have a fully integrated climate change strategy that drives significant maturity in climate change initiatives. Massmart and Spar received C-performance band scores, which demonstrated they are actively involved in climate change with varied levels of integration of those initiatives into strategy (Smith, 2014).

Craggs’ (2012) study indicated that South African retailers have been successful in being ‘green’ focused and installing ‘green’ sourcing methods. A questionnaire focused on transportation, packaging, logistics, accreditation, energy, environmental management, waste management, recycling and training was used to gather the data from the retailers. Two case studies were also conducted on the sourcing of FMCG retailers, and it was found there is a definite need for GSCM with specific attention placed on the procurement processes. Generally, there is lack of awareness, in the transportation sectors and a focus on financial gains instead of the environmental impact (Craggs, 2012).

In some South African companies, GSCM is seen to be a function that mostly affects certain departments or business functions. As confirmed in Smith and Perks’ (2010) study, the business functions least affected by greening initiatives in companies in the

Nelson Mandela Metropolitan area of South Africa are general management, human resources, purchasing or supply chain management, finance and information technology. When the business functions were further analysed, it was revealed the functions most affected by greening initiatives were manufacturing or operations, marketing or sales and distribution or logistics. Therefore, there is still a gap in greening all the functions or departments within organisations because of the perception that GCSM initiatives are only driven by certain functions.

A survey was conducted with 75 companies in the City of Johannesburg Metropolitan region. Eleven industries in the area were studied to determine the green process innovation, greening the supplier and if the green product innovation had an impact on environmental performance and competitive advantage. The study indicated that the benefits of considering the environment and implementing GSCM practices enhanced environmental performance and competitive advantage (van den Berg *et al.*, 2013). Clearly GSCM is receiving much attention in corporate South Africa and companies have implemented programmes to address environmental challenges by reducing the environmental impact of their activities.

2.5. GSCM initiatives

The term Green Supply Chain Management is not often used in business, however companies implement greening initiatives to manage the environmental impact brought about by their operating activities. Studies outline that the concepts and strategies generally considered in GSCM are improved environmental policies, implementation of environmental standards, such as ISO 14001, green product design, green procurement, green material management, green manufacturing process, green marketing and distribution, and reverse logistics (Ghobakhloo *et al.,* 2013; Simpson & Samson, 2008).

A cohesive framework for green supply chain process implementation, as indicated in Figure 2.3, is proposed by Ghobakhloo *et al.* (2013, p87). The researchers found that the

key themes in GSCM literature over the years were the concepts of greening product design, greening material management, greening manufacturing process, greening distribution and marketing and reverse logistics. Highlighted below are some of the strategies that organisations apply in order to achieve environmental and financial performance.

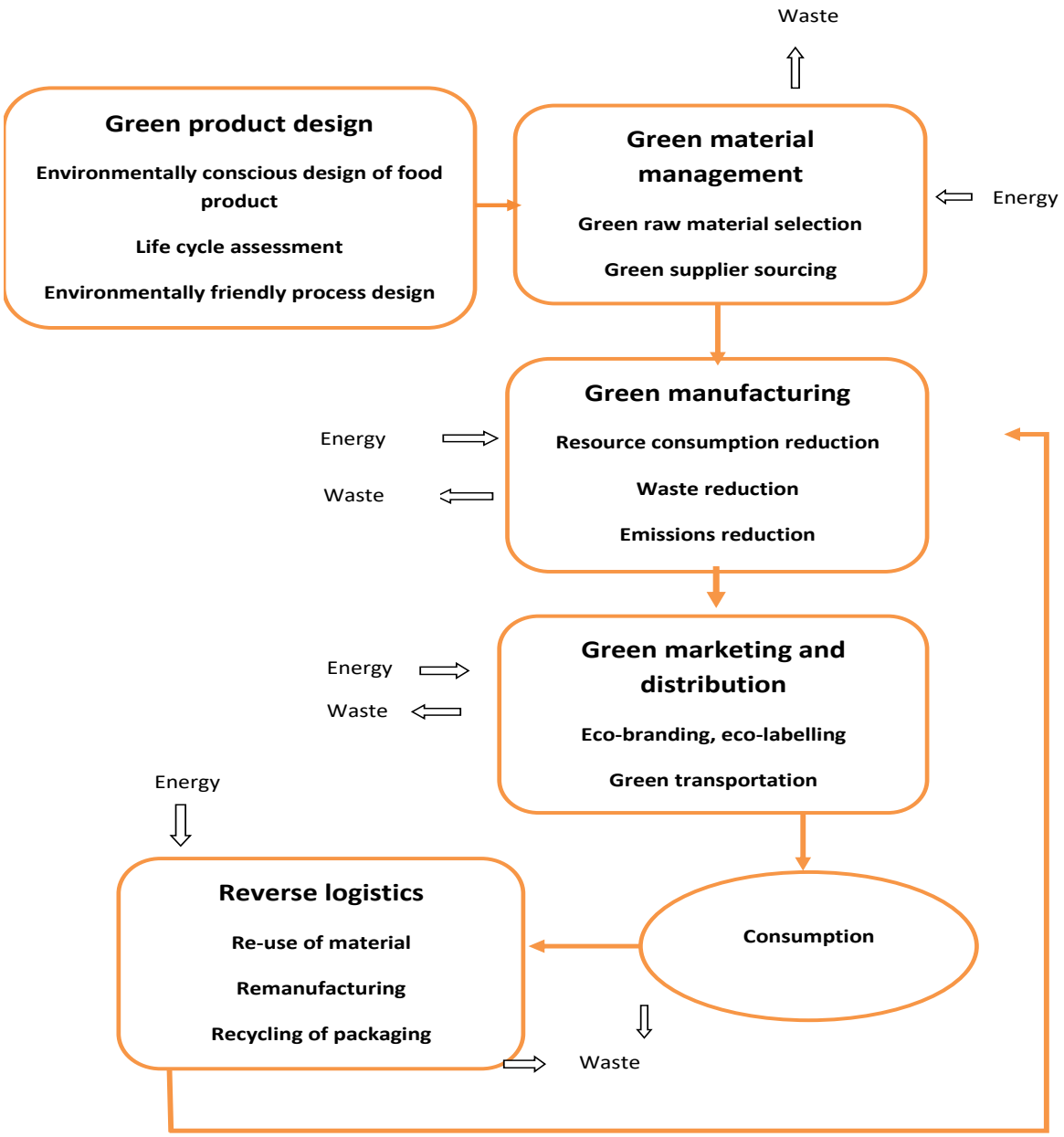

Figure 2.3 Framework for green supply chain process implementation (Source: Ghobakhloo *et al*., 2013, p87)

2.5.1. Improved environmental policies and standards

The top management of companies commit to environmental sustainability and they increase the focus of the organisation by improving environmental policies (Simpson & Samson, 2008)**.** Toke *et al* (2012) further indicated that top management must portray commitment and responsibility for GSCM through policy adoption and endorsement. By endorsing policies, top management ensure different environmental strategies are implemented, which is a critical success factor to GSCM (Gandhia *et al*., 2015; Niemann *et al*, 2016). Top managers support innovation-based strategies to GSCM. These strategies are used by organisations where top management has committed specialised dedicated environmental resources. Companies use supply chain environmental performance standards that are more environmentally specific and require keeping up-to-date with environmental legislation changes and training employees and suppliers in environmentally related process changes (Simpson & Samson, 2008).

These strategies integrate innovative environmental development into specific product and service designs, features, functionality, or life-cycle associated activities, e.g., service, repair, and recycling (Simpson & Samson, 2008). Environmental standards such as ISO 14001 assist businesses in taking a proactive approach in environmental management issues (Craggs, 2012).

2.5.2. Green design

Gardas and Narkhede (2013) suggest that initially, a company should consider redesigning the product itself to reduce the environmental impact and lessen energy consumption in manufacturing, distribution or utilisation. Eco-designing of green practices has been found to have the greatest impact on company performance (Khan & Qianli, 2017). In developed countries, such as those in Europe and Northern America,

governments have encouraged manufacturers to become responsible for the entire lifecycle of their products, including post-consumer disposition; recovering, recycling and re-manufacturing of obsolete products, components and supplies are promoted. Hence, products that facilitate safe, efficient, and cost-effective recovery at the end of their useful life are being designed (Fiksel *et al.,* 2004).

According to Kudroli (2014) and Srivastava (2007), Green product designing, Life Cycle Assessment (LCA) and Environmentally Conscious Design (ECD) are internationally recognised concepts usually employed by companies whereby environmental, occupational health and resource consequences of a product, through all stages of its life, are evaluated. They also indicate that LCA and ECD are used to support product improvement techniques because the overall environmental impact of the product is reduced, and products are designed in consideration of certain environmental aspects The phases of LCA typically involve goal and scope definition of services and products, inventory analysis of extractions and emissions during manufacturing, assessment of environmental impact of manufacturing activities, interpretation of results to evaluate environmental impacts and formulation of scientific solutions to reduce the impact (United Nations Environment Programme, 2014; Wang & Sezen, 2011).

Companies could also green design their buildings and facilities to reduce energy consumption. According to Chang, Rivera, and Wanielista (2011), the energy consumption in buildings can be decreased by up to 70% if a low air conditioning load location is selected, high-energy efficient appliances are utilised and energy-conserving habits are practiced. Buildings and facilities can be “greened” by installing technical hardware such as heat pumps, solar panels, tap water dimmers, urinal control systems and wind turbines to save energy or generate their own green electricity. Energy efficient bulbs, moving detection systems for lighting, hinged doors for refrigerated space and heat recovery systems in cold production facilities could also be installed (Akadiri, Chinyio, & Olomolaiye, 2012; Chel & Kaushik, 2017).

2.5.3. Green procurement

Shifting to greener suppliers that utilise more energy-efficient production processes and less hazardous material ensures companies reduce the entire supply chain carbon footprint (Gardas & Narkhede, 2013). According to Simpson and Samson (2008), companies may use green procurement**,** whereby products that are environmentally friendly are sourced from suppliers who are “green” conscious in their processes. This is the most simple and ideal strategy used by organisations that retain minimal internal environmental management or have recently started to consider greening their supply chains. This is referred to as the risk-based strategy to GSCM (Simpson & Samson, 2008).

This strategy is also referred to as environmental collaboration in which there is direct involvement of the buying company and its suppliers so that environmental goals are set and achieved together (Green *et al*, 2012). This results in the reduction of the environmental impact of coordinated activities as indicated by Gardas and Narkhede (2013). Therefore, Simpson and Samson (2008) mention that in adopting this strategy, suppliers are selected using environmental questionnaires, supplier audits and valuations and stipulated environmental criteria. Suppliers may also be required to undertake independent ISO 14001 certification for environmental management and ISO 20400 certification for sustainable procurement. Hence, suppliers may be required to develop cleaner technology/processes and use the just-in-time (JIT) method to supply raw materials (Simpson & Samson, 2008).

Gardas and Narkhede (2013) suggest that companies revise service level agreements (SLAs) with their suppliers to persuade them into implementing GSCM initiatives in their processes. They envisage that when such SLAs are implemented effectively, there are opportunities for both the buyer and the supplier to save costs. Furthermore, it is stated that *supplier-buyer collaboration creates trust and promotes commitment to the relationship*. Consequently, suppliers are more inclined to invest in developing and adopting GSCM initiatives (Caniëls, Gehrsitz, & Semeijn, 2013)

2.5.4. Green material management and green manufacturing

Simpson and Samson (2008) indicated that some organisations use more complex approaches to GSCM that include the efficiency-based strategy, whereby “eco-efficiency” or “lean-and-green” are promoted. Suppliers are also required to meet operations-based efficiency targets rather than just complying with regulations and international environmental standards. This strategy is used in the processing stage of product making and includes green material management and green manufacturing (Simpson & Samson, 2008)**.** These processes involve the replacement of hazardous material, or processes that make harmful substances safe. In green material management, the processes of material selection, separation and material recovery are supported.

Green manufacturing is about reducing the use of original material sourced directly from nature in its raw form, lowering environmental impact and improving product recovery (Ghobakhloo *et al.,* 2013). According to Masoumik *et al*., (2015) it is through green manufacturing, that processes become highly efficient and generate slight to no waste or pollution. Furthermore, this approach significantly reduces emissions and effluents in the manufacturing process. Total quality environmental management (TQEM), closed-loop manufacturing (zero emissions) and on-site material recovery facilities (MRF) are used (Toke *et al.,* 2010).

2.5.5. Green marketing

As mentioned above, there is increased interest given to the topic of environmental sustainability due to globalisation, technology advancement, social media and availability of information. The increase in the number of countries entering the World Trade Organization has also made GSCM to be practised in many manufacturing companies (Diabat, Khodaverdi, & Olfat, 2013). In addition, the knowledge of the consumer about issues of saving the environment has driven them to demand and prefer environmentally friendly products. This has resulted in manufacturers being interested in green marketing to give them competitive advantages (Beske *et al.,* 2014; Bhatia and Jain, 2013).

Mydock (2014) states that the green marketing model involves product alterations, packaging modification, transformed processes and improved advertising. He indicates that green advertising is of principal importance, whereby a company’s advertisement

presents a corporate image of environmental responsibility and green culture with or without highlighting a product. Furthermore, it is stated that the advertisement often addresses the relationship between a product and the biophysical environment. According to Gandhia *et al.* (2015), including green in a company policy can assist in building the company's brand image in the market, thus food companies can use green marketing to attract more customers and gain more competitive advantage.

2.5.6. Green distribution and reverse logistics

According to Toke *et al.* (2010), in the process of green distribution; packaging, transportation of materials and product are done without negatively impacting human health and the natural environment. They also mention that "direct shipping or hub-and-spoke, central warehouse or distributed network, intermodal or single mode, and third-party services or private fleet" are utilised. Hence, there are "fewer shipments, less handling, shorter movements, more direct routes and better space utilisation." However, it is also mentioned that other organisations use the more complex strategy, which is called the closed-loop strategy, also referred to as "reverse logistics" (Simpson & Samson, 2008). In reverse logistics, re-manufacturing, recycling, re-using, redistribution or disposal with the minimisation of waste are done. Collection, combined inspection/selection/sorting, separation, densification or disassembly, re-processing/direct recovery, transitional processing, delivery and integration are the processes utilised in the supply chain (Kudroli, 2014; Ninlawan, Seksan, Tossapol, & Pilada, 2010; Toke *et al*., 2010).

2.6. Challenges in implementing effective GSCM

Some companies face various challenges and are unable to effectively implement and maintain GSCM programmes. Some of the challenges are described below.

2.6.1. Lack of advanced technical expertise

Gandhia *et al*. (2015) highlight “human technical expertise” as one of the biggest influential factors for achieving successful GSCM implementation. Thus, the lack of advanced information technology and resistance to the adoption of technology improvement hinder the effective implementation of GSCM (Khushbu & Shah, 2014). Pooe and Mhelembe (2014) also support these phenomena as factors that hinder successful GSCM adoption. Advanced and efficient information technology (IT) systems are required for the backing of the activities of GSCM in the manufacturing process. IT systems ensure there is adequate information flow and proper tracking of suppliers used, procured material, production flows, waste flows, energy efficiencies, emissions, distribution, disposal and recycling of materials (Luthra *et al*., 2011; Pooe & Mhelembe, 2014). IT also allows sharing of information and enables instantaneous collaboration and integration between supply chain partners.

Some organisations are resistant to the adoption of technology improvement, which makes it difficult to implement basic change within the organisation. It becomes more challenging when there are changes in the fundamental features of companies, such as objectives, authorities and responsibilities, core technology, operational approach and market strategy (Luthra *et al*., 2011; Pooe & Mhelembe, 2014). Food companies need to have clear strategies to deal with this resistance to ensure their GSCM initiatives are implemented effectively.

2.6.2. Poor motivation and lack of top management commitment

Top management commitment has also been highlighted as an influential factor for achieving successful GSCM implementation (Gandhia *et al*., 2015; Niemann *et al*, 2016). Tay *et al.* (2015) list top management commitment as an internal enabler of sustainable supply chain management, whilst poor management commitment was mentioned by Khushbu and Shah (2014) and Luthra *et al.* (2011) as the most extreme obstacle in implementing GSCM. The responsibilities of top management are to motivate employees to work towards achieving company’s GSCM goals, and to inspire change by enforcing a green culture (Niemann *et al.*, 2016; Ojo *et al*., 2014). Top management also indicate commitment to environmental performance improvement by endorsing sustainability policies and strategies (Brik *et al.*, 2013; Mwirigi, 2016).

Furthermore, top management plays a vital role for the allocation of resources for GSCM adoption (Toke *et al.,* 2012). They may commit dedicated human resources to manage sustainability issues in the form of a sustainability or SHEQ manager, and invest resources for the implementation of environmental management systems, such as ISO 14001. Rewards may be offered to encourage highfliers in the GSCM initiatives and personnel should be supported when they face challenges and be provided with relevant information. In addition, proper training and education are also very important aspects when implementing GSCM, as these aid in up-skilling employees to be able to run with the programmes of the organisation, thus ensuring success of the initiatives. Lack of necessary skilled human resources will result in wasted efforts in implementing greening programmes within an organisation (Ravi & Shankar, 2005). Studies by Luthra *et al.* (2011), Ojo *et al.* (2014) and Pooe & Mhelembe (2014) have also found that in some organisations top management shows no commitment or offer any support to employees to ensure the realisation of successful GSCM programmes. Lack of top management commitment and thus poor motivation will lead to ineffective GSCM programmes (Luthra *et al*., 2011; Ojo *et al*., 2014; Pooe & Mhelembe, 2014). Food manufacturing industries must ensure that employees are motivated and top management is committed to GSCM.

2.6.3. Insufficient government support systems

Central government policies, state government regulations and standards have been indicated as some of the major factors for companies to implement green initiatives (Gandhia *et al*., 2015). Furthermore, government policy and regulations are listed as external enablers for sustainable supply chain management (Tay *et al*., 2015). Luthra *et al*. (2011) mention that government support systems are insufficient to assist organisations in implementing successful GSCM initiatives, and the lack of government support to implement “environmental friendly” policies has been listed as a barrier by Khushbu and Shah, (2014).

Regulatory requirements are viewed as being time consuming. The fees to comply are enormous, discouraging companies from adopting GSCM (Niemann *et al.,* 2016). AlKhidir and Zailani (2009) are cited by Niemann *et al.* (2016), mentioning that new environmental management proposals are not supported by governments because they tend to focus on old methods. The respondents in Pooe and Mhelembe's (2014) study indicated there is unclear policy and poor legislative guidance pertaining to environmental issues from the authorities. It is deemed that set policies and regulations are not prescriptive and do not speak for prevention of environmental risks; legislation is seen to be more about monitoring and correcting. The respondents also mentioned that the government does not see environmental sustainability as a priority (Pooe & Mhelembe, 2014). Muduli and Barve (2013) indicated in India, the issue is that environmental policies and regulations keep on changing with the change of regulatory climates. Companies, therefore react by adopting environmental initiatives to comply with requirements, changing operations whenever there is a change in requirements, instead of proactively instituting environmental management systems (Muduli & Barve, 2013).

2.6.4. Financial implications

Cost has historically been used as the key measure of an organisation's performance. Thus, Gandhia *et al*. (2015) listed financial implications as an important aspect from the point of view of companies in adopting and implementing GSCM initiatives. In most cases, high cost is noted as a major constraint to the successful implementation of GSCM. The initial investment required for green methodologies, such as green designing, green product manufacturing, eco-labelling, etc., are generally too high. Engaging in environmental management involves two types of costs, direct cost and transaction cost (Luthra *et al.,* 2011).

Consequently, the **financial implications** associated with GSCM initiatives bring about a challenge in the implementation process**.** AlKhidir and Zailani (2009) also highlight there are high costs that organisations must be willing to invest to support the processes of green product design, green procurement, green material management, green

manufacturing process, green marketing and distribution, and reverse logistics. Niemann *et al.* (2016) further indicated that cost implications were a major hindrance to GSCM implementation as some companies were more focused on short-term gains rather than the long-term benefits to GSCM.

2.6.5. Lack of collaboration and information sharing amongst stakeholders

The success of GSCM does not depend only on the manufacturing company, it also necessitates strong collaboration with suppliers (Seroka-Stolka, 2016). Hence supplier unwillingness to change towards GSCM has also been cited as one of the challenges to successful GSCM by Luthra *et al.* (2011). Moreover, according to Toke *et al* (2012), poor supplier performance on environmental sustainability may impact the whole GSCM system. The challenge is brought about by the suppliers 'reluctance to shift from traditional operation' and suppliers' difference in aspirations from those of the total supply chain (Mudgal, Shankar, Talib, & Raj, 2009). Supplier-manufacturer associations are considered essential for the development of competitive advantage for the producer. Big automobile industries with approximately 2000 to 3000 suppliers will not be able to produce green products if they do not work in collaboration with suppliers. It is very important that suppliers meet the requirements of customers to uphold industry relationships (Luthra *et al*., 2011).

Lack of collaboration and information sharing amongst stakeholders is another challenge. In Pooe and Mhelembe's (2014) study, organisations mentioned they prefered to use familiar suppliers and were unwilling to use new ones. Therefore the organisations were not exposed to new, improved ideas. The organisations were convinced they should only work in partnerships amongst themselves so that they can share relevant information from their expertise about new developments, plants introduced in the market and evolving technologies.

2.6.6. Lack of knowledge about GSCM

Lack of knowledge and training on GSCM matters has also been cited as a barrier for GSCM successful implementing (Tay *et al.,* 2015). The lack of suitably skilled human resources, lack of training courses, lack of skilled consulting agencies and training institutions to monitor and mentor development specific to each industry have also been listed as barriers (Khushbu & Shah, 2014). In Mozambican manufacturing industries, lack of education and required knowledge were found to be hindering GSCM implementation (Niemann *et al.,* 2016)

It is alluded above that due to increased customer awareness of environmental issues, the demand for green products has increased (Gandhia *et al.,* 2015), making the meeting of complex and diverse customer requirements one of the external pressures for implementing GSCM (Sarkis, Zhu, & Lai, 2010). However, in other developing countries, such as India, customers are not that aware of GSCM so they do not demand “green” products (Luthra *et al*., 2011). Companies will therefore not change their technology and the establishment for innovative green products if customers are not aware and do not require green products. Due to the lack of awareness of the benefits of green products by customers in India, manufacturers are manufacturing products that are not “green” (Luthra *et al*., 2011).

2.7. Employee perceptions towards GSCM

Green supply chain management has been a tool within CSR that supply chains use to reduce the environmental impact of their activities (Sood, 2015). Employee involvement is one of the critical success factors that enables companies to succeed in their GSCM endeavours (Changchutoe, 2012; Toke *et al.,* 2012). Generally, in most businesses, employees are aware of corporate social responsibilities and perceive that their company activities involve “greener” initiatives that impact society in a positive way (Changchutoe, 2012).

According to Changchutoe's (2012) study, CSR is perceived by corporations to be a business tool that is adopted from inception as a development initiative for economic sustainability. CSR encompasses environmental management, employee health and safety, internal resource management and corporate governance (Changchutoe, 2012).

In some cases, top management adopts these initiatives to produce corporate reports that are communicated to public domains to gain some form of endorsement from consumers, NGOs and governments (Rangan, Chase & Karim, 2012). However, Luthra *et al.* (2011) found that , such initiatives by top management do not show commitment or offer any support to the employees in ensuring the realization of successful GSCM programs.

CSR perceptions in company employees is not consistent with the company's data provided, or communicated through public domains (Changchutoe, 2012). Employees in supervisory and executive positions, with a longer period of employment and who have been involved in GSCM activities for some time, often develop optimistic attitudes and have high regard for GSCM policy, operation, benefits and performance of their companies than those employed for shorter periods (Changchutoe, 2012; Smith & Perks, 2010). It has also been noted by Smith and Perks (2010) that small businesses tend to perceive employees in general management, finance, information technology, human resources and purchasing or SCM as the least influenced by green business activities. Moreover, it seems like these small businesses believe that employees in marketing or sales, manufacturing or operations, and distribution or logistics are the most appropriate to practice GSCM. In conclusion, Smith and Perks (2010) recommend that all employees within a company should be encouraged to become involved and to take responsibility for the green initiatives that have been applied.

2.8. Conclusion

This chapter outlined the literature review, aimed at being the continuation of Chapter 1. More research about GSCM was outlined. Key factors that drive many organisations to implement GSCM, the different types of GSCM initiatives that international and South

African organisations have adopted, employee perceptions on GSCM and challenges in implementing effective GSCM programmes were discussed. Furthermore, the Gauteng starch and glucose processing industries and their environmental impact were discussed. This is important information as it links with the objectives of the study, the research question and the topic.

CHAPTER 3

RESEARCH METHODOLOGY

3.1. Introduction

Research methodology is referred to by Welman, Kruger and Mitchell (2005) as the process that aims to explain the rationale behind research approaches and techniques that have been adopted for a particular study. This chapter outlines the processes and techniques utilised for the study. In this section, the research design, population, sampling method, instrument for data collection, instrument administration, timelines, types of statistical and inferential analyses and ethical considerations are described in detail. The structure of the questionnaire is outlined, and respondents defined.

3.2. Research design

The research design followed in this study was the descriptive quantitative method. As alluded to in the first chapter, this research used a closed-ended survey questionnaire to investigate the perceptions of employees, in the starch and glucose processing industry, towards GSCM practices implemented in their organisations and to determine the level of their involvement and awareness of these initiatives.

The other sub-objectives of the study were to evaluate the level of employee awareness of environmental goals and targets, environmental policies, legislation and standards and green designing initiatives implemented to assess their perceptions towards the GSCM partnerships their companies have implemented with suppliers, contractors, including the government; to evaluate if employees recognise the benefits of green marketing campaigns and GSCM initiatives; to identify the barriers hindering the effectiveness of GSCM implementation. It must be highlighted as well that the investigations in this research were done without intervention, modification or influence on the participating respondents and food manufacturing companies involved, hence the research was descriptive in nature.

According to Creswell (2012) and Leedy and Ormrod (2010), descriptive quantitative research designs are used when a researcher seeks to analyse a situation as is, without modification or application of treatment during that investigation. Moreover, Kothari (2009) explains that the intention of descriptive research methods is to describe the attributes of particular individuals or a group with the aim of making specific predictions, with a narration of facts concerning them. In descriptive quantitative studies, the researcher explains a trend so that a solution to the research problem is provided. In addition, the investigator wants to ascertain the overall tendency of responses from respondents and deduce how this tendency differs among them (Creswell, 2012).

It was mentioned in Chapter 1 that survey research designs in quantitative studies, as described by Creswell (2014) and Leedy and Ormrod (2010), are methods that involve discovering people's opinions towards a subject by asking them questions and tabulating their responses. These methods provide a mathematical explanation of trends of the viewpoints or beliefs of the respondents by studying a sample of the population. In survey research designs, investigators gather the quantitative data using measuring instruments or tools, such as mailed questionnaires, tests, one-on-one interviews, or rating scales, to assess the phenomena under examination (Johnson & Christensen, 2008; Leedy & Ormrod, 2010).

The data is analysed with the use of statistics so that the trends of the responses to questions are described, and research questions of interest or hypotheses are tested. The meaning of the data is also interpreted by comparing results of the statistical assessment to previous research studies (Conrad & Serlin, 2011; Creswell, 2012).

3.3. Population and sampling method

The method of selecting respondents was nonprobability sampling, more specifically, maximum variation purposive sampling. This method of sampling is also referred to as a heterogeneous, judgment-based, selective or subjective sampling technique because the study needs a representation of people of different perspectives concerning the subject being studied (Etikan, Musa, & Alkassim, 2016; Leedy & Ormrod, 2010). For this study's objectives to be met, and for main research question and sub-questions to be answered, perspectives or opinions of employees within the starch and glucose processing industry towards GSCM were required for assessment. The employees were working in various departments within their companies, namely procurement, logistics, processing/production, engineering/maintenance and SHEQ.

Accordingly, a list of relevant starch and glucose processing companies in Gauteng province, South Africa, was compiled with data obtained online from the Kompass International, the Foodstuff South Africa and the Yellow Pages companies' directories. Twenty companies, as found in the directories, were approached with the aim of obtaining a minimum of five companies for the research due to accessibility and convenience. Five companies gave approval for their companies and employees to participate in the research.

Employees working in management and supervisory positions in the procurement, logistics, processing/production, engineering/maintenance and SHEQ departments were considered. These employees are usually involved in the implementation of improved environmental policies, meeting green supply chain goals and targets, green product designing, green procurement, green material management, green manufacturing, green marketing and distribution, and reverse logistics. These are the GSCM initiatives that are generally considered for green supply chain process implementation (Islam *et al.,* 2017; Kudroli, 2014; Simpson & Samson, 2008).

Creswell (2012) mentions that non-probability sampling is used when the researcher chooses respondents who are accessible, convenient, and represent some attribute the examiner wishes to assess. Welman *et al.* (2005) further state that purposive sampling is used when researchers have previous research findings about their particular study and

deliberatly acquire units of analysis in a manner that the respondents may be viewed as being representative of the appropriate population.

Thus, the respondents in this study were considered as being relevant to represent opinions of employees within the starch and glucose processing industry in Gauteng about GSCM. The sample size targeted for this study was 150 respondents. The questionnaires were distributed via email after employee information was made available. The type of sampling technique used was non-random, which does not require underlying concepts or a fixed number of respondents (Etikan *et al.,* 2016) due to the variations in food company sizes, and the number of managers or supervisors in the relevant departments within the companies.

3.4. Research instrument for data collection

The data collection was done using a structured survey with closed-ended questions and a 5-point rating scale that had questions relating to environmental policy, legislation and environmental management standards; green procurement, partnerships with suppliers, contractors and the government; green designing; environmental risk impact assessment; employee involvement, training and awareness; environmental performance reporting; environmental labelling/eco-branding and green marketing; barriers to achieving a "green culture."

The survey was posted on the internet using Google Docs and a link emailed to the targeted respondent in the participating companies. A survey questionnaire was preferred because the aim of the research was to obtain the perceptions of the respondents towards GSCM. Surveys are also convenient, and anonymity can make information more readily shared by the respondents without difficulty (Creswell, 2014; Leedy & Ormrod, 2010; Welman *et al.,* 2005)

The survey questionnaire was constructed from the objectives and literature relating to GSCM initiatives implemented in the starch and glucose production and processing industry in Gauteng (Table 3.1). The survey questionnaire was completed by employees in managerial and supervisory positions in the in the procurement, logistics,

processing/production, engineering/maintenance and SHEQ departments. The respondents answered anonymously by ticking the appropriate answers on the questionnaire.

The Likert Rating Scale, or summated method, was used for the questionnaire design. A Likert Scale is an attitude scale introduced by Rensis Likert in the 1930s to measure people's attitudes towards a subject. It is easier to compile than other attitude scales and is more advantageous when the researcher seeks to assess behaviour, mind-set, or another phenomenon of interest (Leedy & Ormrod, 2010; Welman *et al*., 2005). A 5-point Likert-type response measure was used in the current study where 0 was for "not applicable" 1 for "I am not sure", 2 for "no, not at all", 3 for "partially" and 4 for "yes fully" to ensure overall consistency throughout the questionnaire as outlined in Annexure 1.

3.5. Pilot study

A pilot study was conducted whereby a company that processes starch and glucose to produce products for human consumption was selected using convenience sampling. The survey questionnaire was sent to five employees in the departments of logistics, processing/production and SHEQ, as per availability of their email addresses. After follow-up was made, three employees returned the questionnaire. Responses to the questionnaire for the pilot study were tabulated on the on-line spreadsheet and the information was exported to an MS Excel 2013 spreadsheet, then the data sent via email was added for statistical analysis using the PHStat2 add-in statistics package for Microsoft Excel 2013.

Data was evaluated from the questionnaires from employees in SHEQ and production departments. Since only employees from two categories (SHEQ & production) returned the questionnaires, the Wilcoxon Rank Sum Test was used to obtain a p-value of 0.602 for the questions. A p-value above 0.05 level of significance indicated the results could be accepted, as there were no significant differences in how employees responded to the questionnaire.

The questionnaire was therefore acceptable as a reliable instrument for data collection for the study. The Wilcoxon Rank Sum Test is a nonparametric test used to compare two groups when data is ordinal which is based on the order in which the observations from the two groups fall (Leedy & Ormrod, 2010).

3.6. Questionnaire administration

The on-line questionnaire was successfully distributed via email to the different respondents, depending on the preference of the participating company. A paper by Andrews, Nonnecke and Preece (2003) argues that on-line surveys are superior to email surveys in multiple aspects, however when combined with email or perhaps with other forms offline media, on-line surveys are an excellent tool for inviting persons to participate in research surveys. The survey was longitudinal, as data was collected over time for this study. About three follow-ups through email and telephone calls were made to ensure that all the questionnaires were returned timeously and that a significant response rate was obtained, partly following the Dillman's Total Design method as suggested by Creswell (2014).

3.7. Data management and analysis

Descriptive statistical methods were used to make conclusions about the data that was collected. Statistics involve the gathering, processing, analysing and interpretation of numerical values, and drawing statistical inferences and generalisations about a population. Generalisations based on this analysis are never statements of absolute certainty. Thus, descriptive statistics were used to describe the pattern of the data, where the data centre or midpoint is, how broadly they are spread, how certain variables within the data are correlated with each another, etc. Inferential statistics, conversely, allow researchers to make suggestions about large populations by collecting data on reasonably small samples and then estimating the characteristics of the larger population from which the sample had been taken (Johnson *et al.,* 2011; Leedy & Ormrod, 2010; Phophalia, 2010; Welman *et al.,* 2005).

Responses to the questionnaire in this study were tabulated on an on-line spreadsheet and the information exported to an MS Excel 2013 spreadsheet. The descriptive statistical methods used to present and summarise the answers on the questionnaire were column diagrams, pie-charts, percentages, means and p-values of 0.05 at 95% confidence level. Means were used to mathematically describe the arithmetic average of the scores within the data sets. The means were obtained by determining the average scores under a 5-point Likert-type scale for each question on the survey (Johnson *et al.,* 2011; Leedy & Ormrod, 2010).

The analysis of the results of the responses to the questionnaire were outlined by denoting the following aspects to answer the research questions and fulfil the main purpose of the study:

- The frequencies and percentages of answers for each question aimed to reveal the level of employee awareness of environmental management systems, environmental policies, legislation and standards, goals and targets and green designing initiatives implemented, as per sub-objective one of this study.
- The frequencies and percentages of answers for each question aimed to reveal the perceptions of the employees towards GSCM partnerships that their companies have implemented with suppliers, contractors, including the government, to fulfil sub-objective two of this study.
- The frequencies and percentages of answers for each question aimed to reveal if employees recognised the benefits of green marketing campaigns and GSCM initiatives within their companies, to fulfil per sub-objective three of this study.
- The frequencies and percentages of answers for each question aimed to reveal barriers identified as hindrances of effective GSCM implementation, as per sub-objective four of this study.
- The averages for employee answers for all questions revealing overall perceptions of employees towards GSCM initiatives implemented in their companies and the level of awareness of the GSCM practices applied.

The PHStat2 add-in statistics package for Microsoft Excel was used to compute the Kruskal-Wallis H tests to determine if there were significant differences in the scoring

tendencies between the SHEQ, production, procurement, logistics and engineering employees' answers in the survey questionnaire. The Kruskal-Wallis rank test (at times also termed as the "one-way ANOVA on ranks") is a rank-based nonparametric statistical test that can be utilised to determine if there are statistically significant variances between three or more group means when data are ordinal (Leedy & Ormrod, 2010; Levine, Ramsey, & Smidt, 2001).

Furthermore, the *t*-test function in MS Excel was used to determine whether there were statistically significant differences in GSCM awareness between SHEQ and the other departments.

3.8. Ethical considerations

This research was approved by the University of South Africa's Research Ethics Committee and was conducted with approval by participating food companies and consent from questionnaire respondents. The respondents gave consent on the questionnaire by answering the question "I agree with the above and would like to give consent to complete the questionnaire." The researcher is responsible to ensure that the value of the research is explained to the respondents, their rights must not be violated, their safety must be guaranteed, and their consent must be obtained. According to Cooper and Schindler (2008), research must be conducted in a way that respondents are not made to suffer physical harm, pain, discomfort, or loss of privacy. The names of the people and companies involved were not disclosed for confidentiality purposes. Approval was granted for the use of diagrams in this study.

3.9. Conclusion

This chapter has outlined the processes and techniques utilised for this study. In this section the research design, population, sampling method, instrument for data collection, instrument administration, timelines, types of statistical and inferential analyses,

limitations, delimitations, ethical considerations, validity and reliability were described in detail. The structure of the questionnaire was also outlined, and respondents were defined in detail.

CHAPTER 4

RESULTS AND DISCUSSION

4.1. Introduction

In this chapter the results, interpretation and discussion of the study are outlined. The data was entered using a Microsoft Excel 2013 spreadsheet and explained using descriptive statistical methods to determine the frequencies, percentages, means and p-values of 0.05 at 95% confidence level. The data in this chapter is presented to indicate the perceptions of employees in the Gauteng starch and glucose processing industry towards GSCM initiatives implemented in their companies, and determine if employees were aware of the different GSCM practices applied.

Furthermore, the data illustrates the level of employee awareness of specific GSCM practices that include the environmental goals and targets, environmental policies, legislation and standards, and green designing initiatives implemented. The data shows the level of employee awareness of GSCM partnerships their companies have implemented with suppliers, contractors, including the government. The analysis further indicates whether employees have recognised any benefits of green marketing campaigns and GSCM initiatives. Lastly, it identifies the major barriers hindering the effectiveness of GSCM implementation.

4.2. Respondents and response rate

After approval by food companies willing to participate in the study, the online survey was circulated to the respondents using maximum variation purposive sampling, where a representation of people of different perspectives concerning the research were targeted. As already mentioned in Chapter 3, employees working in management and supervisory positions in the procurement, logistics, processing/production, engineering/maintenance and SHEQ departments were approached.

Twenty (20) of the relevant food manufacturing companies in Gauteng province, South Africa, were approached to participate in the study depending on the access to such companies. This was done with the aim of achieving a bigger population, however only five of the companies gave approval but this still gave the researcher a target sample of 150 respondents. Hence, 150 emails were distributed to different respondents working in the relevant food companies with a link to the online survey. Eighty-four (84) replies were received, of which 80 were considered valid. The four discarded questionnaires indicated the employees were in other provinces of South Africa, therefore the overall response rate was 53%.

4.3. Classification and coding of responses

The analysis and the assumptions made from the data in this chapter were based on the responses from the employees distributed in categories, as indicated in Table 4.1 below.

Table 4.1. Sample distribution according to employee position

Position	Number of respondents	Percentage%
SHEQ supervisor/manager	28	35
Production/operations/processing supervisor/manager	23	29
Engineering/maintenance supervisor/manager	17	21
Materials/logistics supervisor/manager	10	12
Procurement supervisor/manager	2	3
Total	**80**	**100**

Table 4.1 indicates the highest response (35%) of the survey questionnaires was completed by employees in the SHEQ department, 29% were employees in the

production/operations/processing department, 20% in engineering/maintenance department, 13% in materials/logistics department and 3% in the procurement department. The above-mentioned employees were working in the Gauteng food industry where starch and glucose are processed to make products for human consumption.

4.4. Analysis of results

4.4.1. Analysis of employee GSCM awareness and involvement.

Figure 4.1 indicates that on average, a few (12%) of the employees in the GP starch and glucose industry were not sure about the state of GSCM practices implemented in their companies.

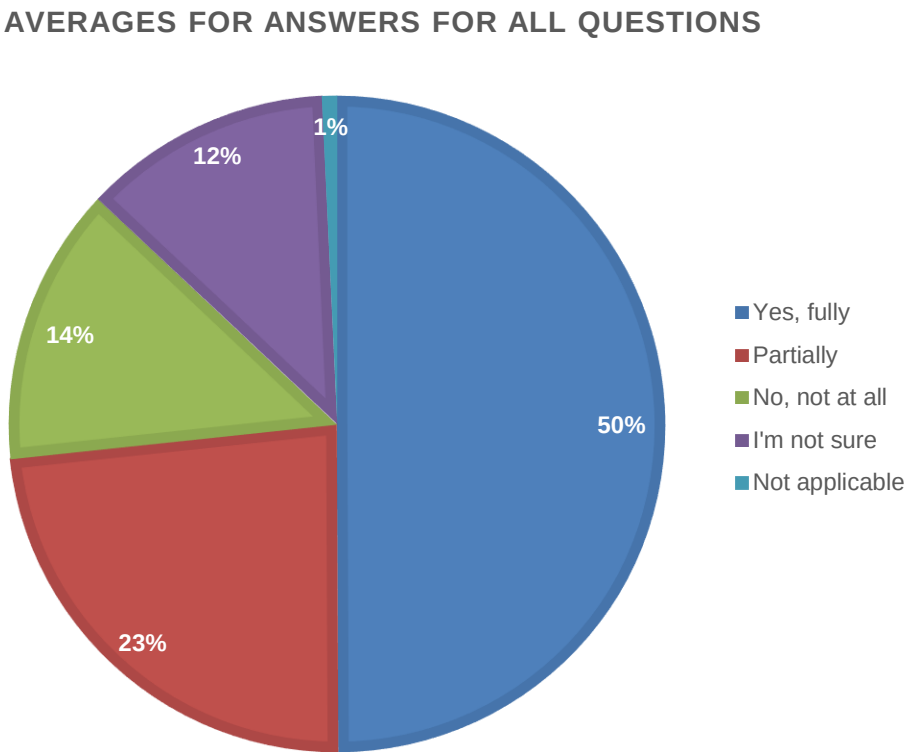

Figure 4.1. Averages for employee answers for all questions

Otherwise, most (50%) employee answers were “yes, fully,” 23% were “partially,” and 14% were “no, not at all” indicating most employees were aware and involved in the

GSCM practices implemented in their organisations to address environmental sustainability. As mentioned in Chapter 1, employee involvement is a critical success factors that drives effective GSCM strategies. The results indicate that in general, employees knew the status of GSCM in their organisation.

Successful GSCM strategies should be systematically implemented in a “closed-loop oriented” approach that considers improved environmental policies, green product design, green procurement, green material management, green manufacturing process, green marketing and distribution, and reverse logistics (Kudroli, 2014; Liu & Chang, 2017; Luthra *et al*., 2011). Employees must be thoroughly trained and informed of these.

4.4.2. Awareness and training of employees on environmental management systems

Most of the employees in the GP food industry were aware of the environmental management systems implemented in their companies. Firstly, Figure 4.2 shows that according to most employees, environmental management systems and sustainability standards (79%) that have been implemented in GP food companies are the following:

Top management commitment of a dedicated resource to manage sustainability issues in a form of a sustainability or SHEQ manager, as indicated by 99% of employees, environmental sustainability/SHEQ policies endorsed by the board or top management (96%) and having valid environmental certification such as ISO 14001 (90%). It is further indicated by 86% of employees that their companies have environmental management systems that are compliant with relevant environmental legislation.

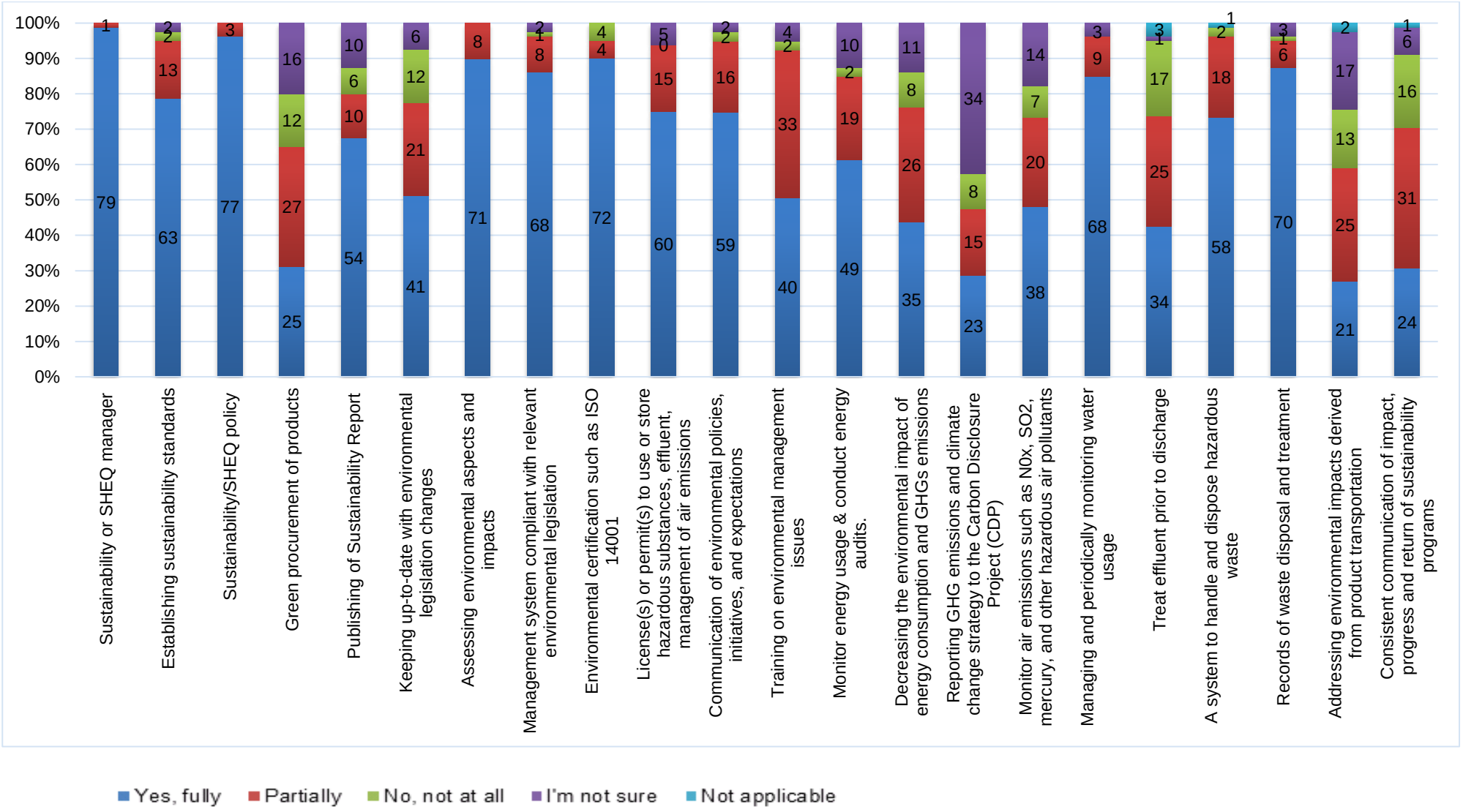

Figure 4.2. Employee perceptions on environmental management systems, policies, legislation and standards

Secondly, the results further indicate that food companies practice the following activities to meet legislative requirements:
Most employees (51%) illustrated that their companies kept up-to-date with environmental legislation changes; companies assessed environmental aspects and impacts associated with their operations (90%); they kept records of waste disposal and treatment (88%); they managed and periodically monitored water usage (85%).

Environmental risk assessment has been noted by Simpson and Samson (2008) as the easiest and less resource-requiring strategy to greening an organisation's supply chain that most companies, who have just started working towards being "green," adopt. Food companies keep up-to-date with environmental law changes and train suppliers in environmentally related process changes. This indicates companies have dedicated environmental resources and considered an innovation-based strategy to GSCM (Simpson & Samson, 2008).

Most employees (73%) indicated their companies had systems in place to handle and dispose of hazardous waste. Employees (61%) showed that their companies monitored energy usage and conducted energy audits as required by applicable standards and legislation. Seventy-five percent of them indicated that companies had the necessary license(s) or permit(s) for use or storage of hazardous substances, effluent, management or air emissions.

Moreover, a significant number of employees (44%) indicated their companies had measures in place to decrease the environmental impact of energy consumption and greenhouse gas emissions; 32% indicated these measures are partially in place in their companies.

A considerable number (48%) of employees in the GP food companies indicated their companies monitored air emissions, such as N0x, SO2, mercury and other hazardous air pollutants, periodically. Employees (43%) indicated their companies treated effluent prior to discharge, while 31% showed their companies partially treated waste water.

This high focus on implementation of pollution prevention strategies and training could be driven by the legislative pressures to which the starch and glucose processes find themselves subjected. Research has found it is primarily for the reasons to avoid verbal and written warnings, penalties, court cases, legal liability claims, criminal prosecution and major reputation erosion brought about non-compliance with legislation and regulations that companies pursue GSCM (Laosirihongthonga *et al*., 2013). It is therefore recommended that companies take a "product stewardship" approach rather than the pollution prevention approach to GSCM, due to it being more integrated and going beyond the companies' internal processes to suppliers, distributors and end-users. This approach includes greening of every stage of a product's lifecycle (Masoumik *et al*., 2015).

Thirdly, Figure 4.2 indicated the following about communication and training on environmental issues:
Companies communicated environmental policies, initiatives, and expectations to suppliers, employees and contractors, as indicated by 75% of the employees. Sustainability reports that can be accessed by all employees, consumers and relevant stakeholders are published, as indicated by most employees (67%).

Most (51%) employees showed that their companies trained suppliers on environmentally relevant process changes. Furthermore, most (51%) employees are trained on environmental management issues, such as handling of hazardous substances, air emissions, effluent management, water use, hazardous waste management, preventing soil and ground water pollution and energy management.

Lastly, Figure 4.2 illustrated there are least, or partially, implemented environmental management systems in GP food industries. Employees (34%) indicated policies for green procurement of products for their internal use as being partially implemented. Employees (42%) were not aware that greenhouse gas emissions and climate change strategies are reported annually to the Carbon Disclosure Project (CDP). Green procurement will ensure that only environmentally friendly raw material and services are sourced (Paulraj, 2011).

A small number (27%) of employees indicated their companies were fully addressing environmental impacts derived from product transportation, while 32% of them indicated their companies were partially addressing this situation. Furthermore, (40%) of employees in the GP food industry indicated their companies partially communicated the impact, progress and return on sustainability programmes to employees, consumers and all relevant stakeholders.

It has been alluded to above that the implementation of environmental policies and standards encompasses the whole GSCM framework within a food supply chain. The ISO 14001 standard assists businesses to take a proactive approach in environmental management issues. Companies that have adopted ISO 14001 may be more likely to have a greater propensity to extend their "green" focus past their organisational boundaries and use GSCM initiatives to reduce environmental impacts in the entire system (Craggs, 2012; Darnall, Jolley, & Handfield, 2006; Seroka-Stolka, 2016). Therefore, food companies may improve training of employees on environmental management matters, as training is one of the critical success factors that enables success in their GSCM endeavours (Changchutoe, 2012; Toke *et al*., 2012)

4.4.3. Environmental goals and targets

When it comes to environmental goals and targets implemented in GP food companies (Figure 4.3), 64% of employees indicated most companies have put in place environmental targets and objectives aimed at enhancing environmental performance, 73% reported companies were reviewing environmental performance periodically through management reviews; 58% said companies set goals and targets to reduce energy consumption and water usage, and 54% indicated reusing or recycling water.

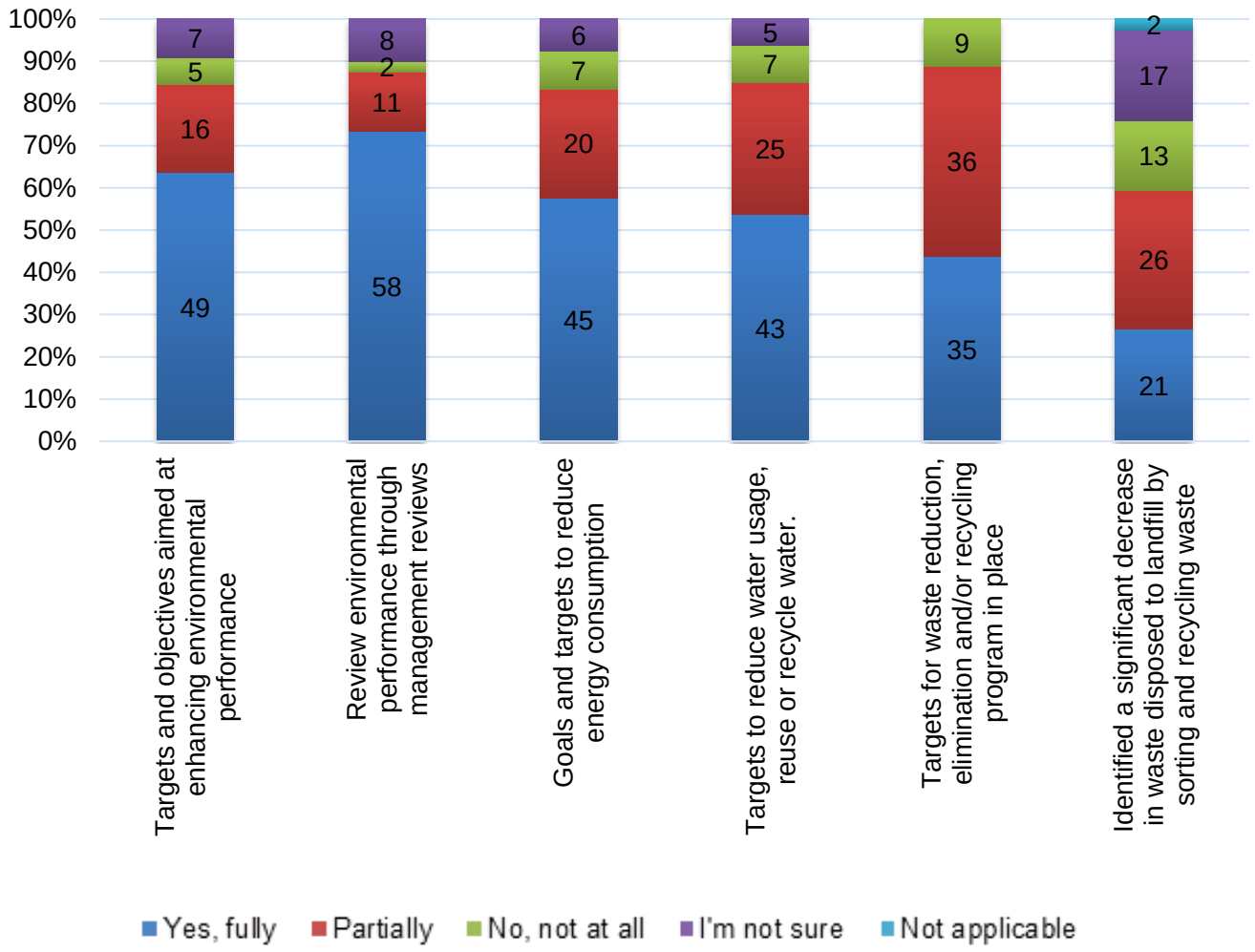

Figure 4.3. Employee perceptions on environmental goals and targets

However, waste reduction, elimination and recycling programmes with targets were partially implemented. This was indicated by 45% of employees.

Moreover, a considerable number (33%) of employees indicated their companies had seen a slight decrease in waste disposed to landfill by sorting and recycling waste, while 27% indicated their companies had seen a significant decrease of waste disposal to landfill.

In reverse logistics remanufacturing, recycling, reusing, redistribution or disposal with the minimisation of waste are done. Reverse logistics is a *closed-loop strategy* that incorporates environmental performance to the whole supply chain (Simpson & Samson, 2008; Toke *et al.,* 2010).

4.4.4. Green designing initiatives

Figure 4.4 demonstrates employee awareness on green designing initiatives. Green designing initiatives have not quite been fully implemented in food companies in GP. Most (59%) employees in GP food companies indicated their companies had not greened the design of buildings and facilities, while 47% indicated partially improved energy efficiency by installing energy efficient equipment, and 21% indicated their companies had fully greened the design of buildings and facilities.

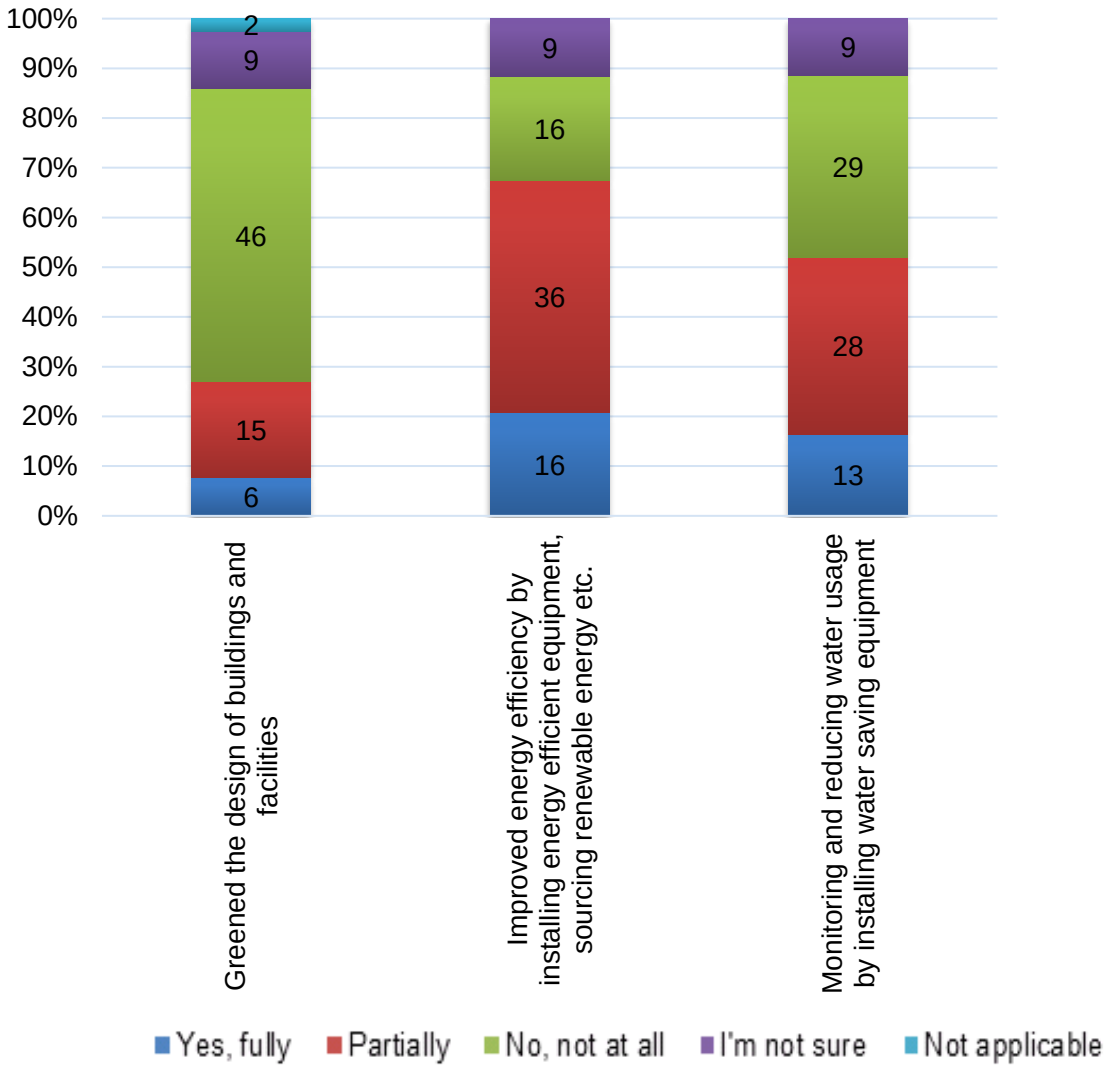

Figure 4.4. Employee perceptions on green designing initiatives

Energy efficiencies have not been fully improved by monitoring and reducing water usage in the GP food industry, as indicated by (37%) of employees. Moreover, 35% of employees indicated that their companies had partially improved energy efficiency by monitoring and reducing water usage. Food companies are encouraged to design products that are “environmentally friendly,” that can be reusable or recycled. Production processes must be designed so that wastes and emissions are reduced.

4.4.5. Partnerships with suppliers, contractors including the government

Figure 4.5 shows employee awareness in relation to partnerships with suppliers, contractors including the government.

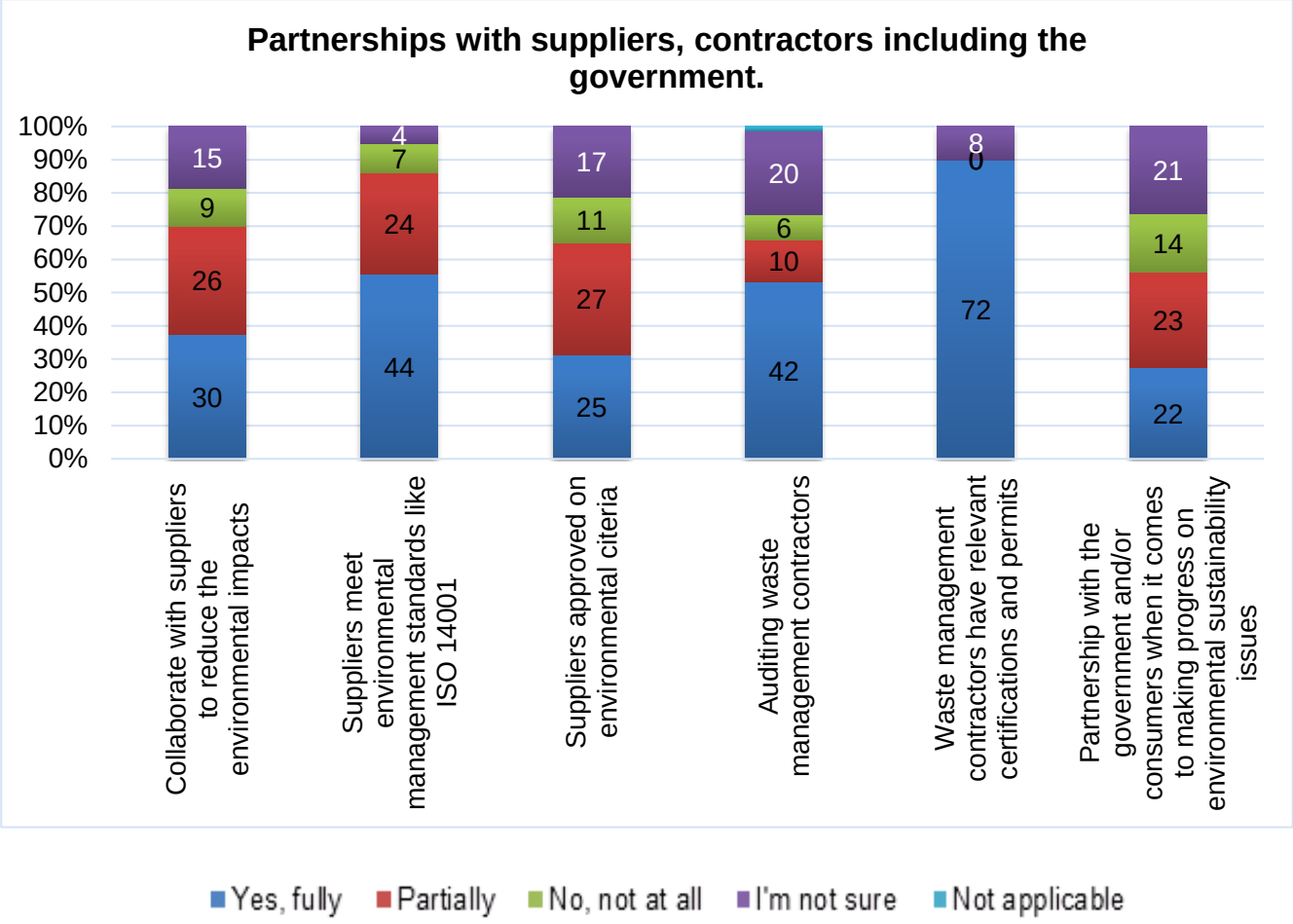

Figure 4.5. Employee perceptions on company partnerships with suppliers, contractors including the government.

Companies excel in partnerships with waste contractors and this has been fully implemented, as reported by 90% of respondents. Waste management contractors of these food-manufacturing companies have relevant certifications and permits. Respondents (56%) indicated their companies fully require their suppliers to meet all relevant regulatory requirements and international environmental management standards, such as ISO 14001. Furthermore, 53% of employees indicated their companies fully audit their waste management suppliers.

Companies also fully, or partially, demand and collaborate with suppliers on reducing the environmental impacts of their activities and products, as indicated by 37% and 33% of the respondents respectively.

Suppliers used by companies are vetted and approved based on environmental questionnaires, environmental audits and assessments or environmental criteria, as indicated by a considerable number (35%) of employees. When it came to partnerships with the government and consumers on environmental sustainability issues, 29% of employees in the GP food industry indicated these partnerships are partially in place, while 27% were not sure if such partnerships were in place.

It is therefore important for the buyer–supplier relationships to improve so that the environmental impact of suppliers and company manufacturing activities are significantly reduced, ensuring that direct and indirect environmental problems are eliminated or reduced throughout supply chains (Kumar & Chandrakar, 2012).

4.4.6. Green marketing campaigns and competitive advantage.

Figure 4.6 demonstrates the results on employee answers for green marketing campaigns and competitive advantage.

Award schemes have not been introduced to acknowledge and encourage employees' positive actions towards sustainability or maintaining a 'green' culture. This was indicated by most employees (67%). A considerable number (38%) of employees indicated their

company products had not been eco-branded, whilst 23% said a few products had not been eco-branded.

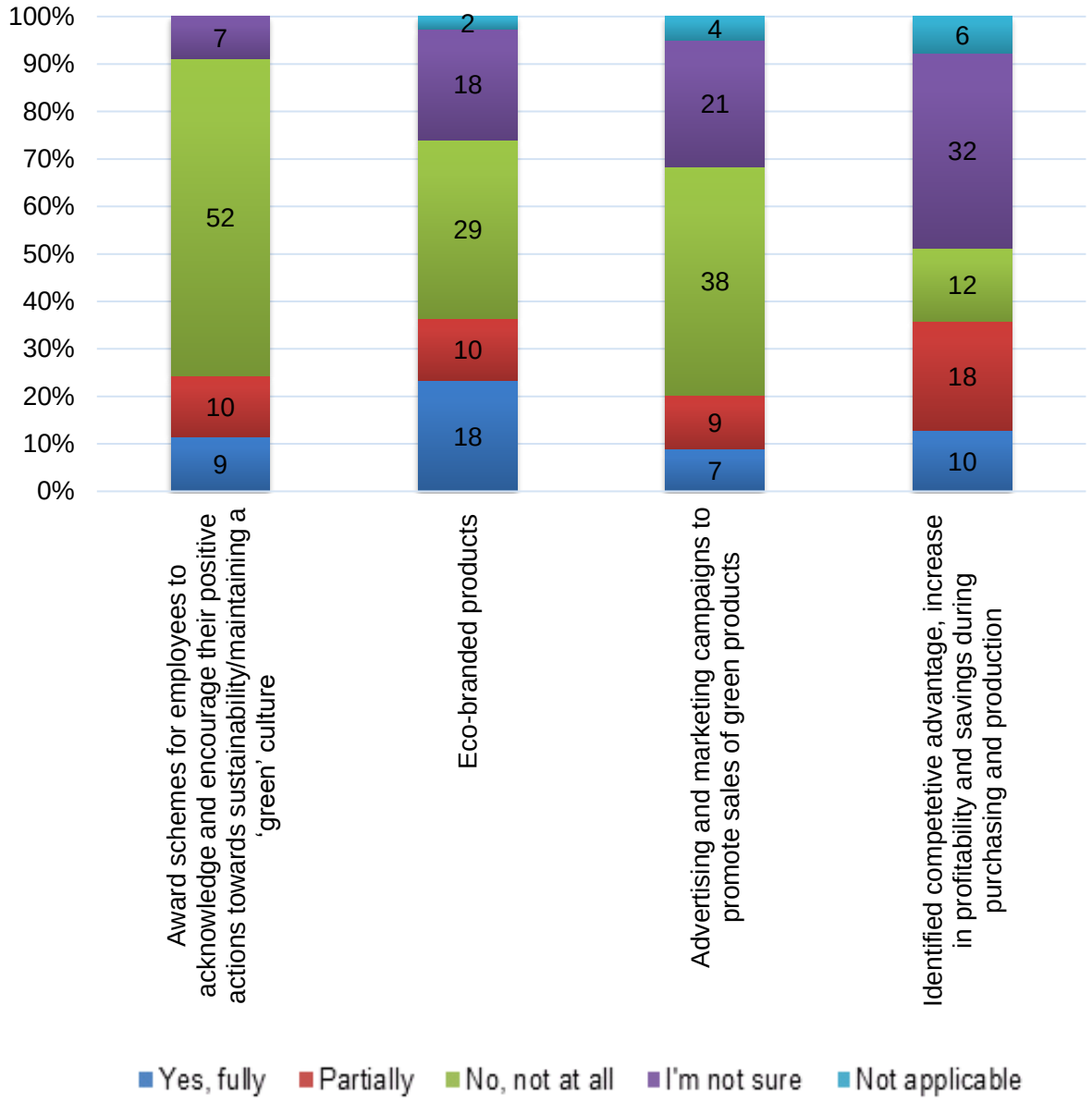

Figure 4.6. Employee perceptions towards green marketing campaigns and competitive advantage.

A considerable number (48%) of employees indicated their companies had not launched advertising and marketing campaigns to promote sales of green products, while 27% indicated they were not sure if their companies had launched such campaigns. This gap

can be closed by top management, as rewards may be offered to encourage highfliers in GSCM initiatives, motivating them to work towards achieving the company's GSCM goals (Ravi & Shankar, 2005). Thus, green advertising is of principal importance, as a company's advertisement presents a corporate image of environmental responsibility and green culture, with or without highlighting a product. The advertisement would address the relationship between a product and the biophysical environment (Mydock, 2014). Competitive advantage could be gained by food manufacturers using green marketing, as it has been highlighted that this is likely to give those benefits (Beske *et al*., 2014; Bhatia and Jain, 2013).

Employees (41%) indicated they were not sure if their companies had identified an advantage over their competitors, or seen an increase in profitability and savings during purchasing and production, since the implementation of GSCM initiatives. 23% indicated their companies had identified a slight advantage in both aspects.

4.4.7. Barriers hindering effective GSCM implementation

Figure 4.7 demonstrates employee barriers hindering effective GSCM implementation.

Most (86%) employees perceived that improved communication, training and education would assist their companies to achieve successful GSCM implementation. Consequently, poor communication, lack of training and education were hindrances. Resistance to change & technology advancement adoption were indicated by 41% of employees to be partially hindering effective implementation & maintaining of a "green culture," while 27% indicated that they were hindrances.

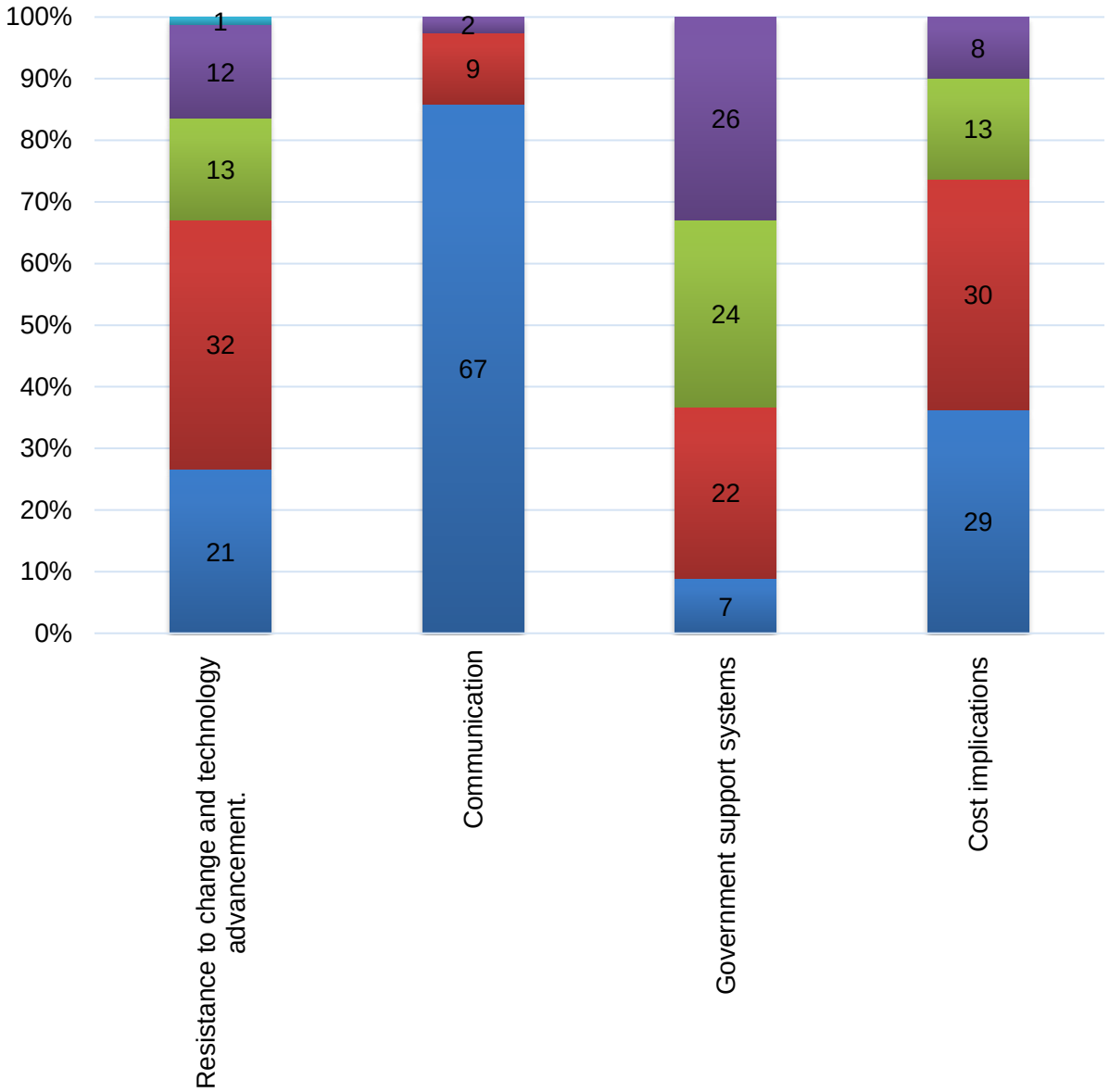

Figure 4.7. Employee perceptions towards barriers hindering effective GSCM implementation.

In the case of government support systems, a considerable number (32%) of employees indicated they were not sure if government support systems were sufficient to assist their companies in implementing efficient GSCM initiatives. Employees (30%) indicated government support systems were not sufficient. Improved partnership with government could facilitate information sharing and monitoring of companies for successful green

supply chains (Nezakati, Fereidouni, & Rahman, 2016). Improved government support could therefore facilitate information sharing and monitoring of companies for successful green supply chains (Nezakati *et al.,* 2016). This may be improved by strengthening manufacturer-government relationships.

As already alluded to, there are high costs that companies must be willing to invest to support the processes of green product design, green procurement, green material management, green manufacturing process, green marketing and distribution and reverse logistics (AlKhidir & Zailani, 2009). However, cost implications were highlighted by 38% of employees as a partial barrier to implement successful GSCM initiatives, with 36% indicating cost implications to be the major barrier. Top management, as well as the SA government, could dedicate more resources in this area to ensure that GSCM initiatives adopted by food manufacturers are successful.

4.5. Inferential Statistical Analysis

4.4.1. Kruskal-Wallis Rank Test for department responses

The data was further analysed using the PHStat2 add-in statistics package for Microsoft Excel to compute the Kruskal-Wallis H tests (Annexure 3) to determine if there were significant differences of 95 % (p=0.05) in the scoring tendencies between the SHEQ, production, procurement, logistics and engineering employees' answers in the survey questionnaire.

In Annexure 3, the Kruskal-Wallis Rank Test showed (p>0.05) no significant differences in the scoring tendencies between the SHEQ, production, procurement, logistics and engineering employees' answers in the survey questionnaire, except for question 36 (p-value of 0.039). This means that awareness GSCM implementation in the GP starch and glucose processing industry is spread throughout all departments within companies. Therefore, the results of this survey can be accepted, except for question 36, where p-value is <0.05 of reduced waste to landfill.

4.4.2. *t*-Tests for differences in GSCM awareness between the SHEQ and other departments

Table 4.2 indicates that the level of awareness of environmental management systems, policies, legislation and standards between SHEQ and the other departments was not significantly different ($p > 0.05$).

Table 4.2. *t* Tests analysis on environmental management systems, policies, legislation and standards

	Mean	SD	Observations	Degrees of Freedom	t Critical two-tail	*p* value (1 tail)
SHEQ Production	5.59 4.40	6.87 6.11	5	8	2.31	0.39
SHEQ Procurement	5.59 0.4	6.87 0.89	5	8	2.31	0.07
SHEQ Logistics	5.59 2	6.87 2.92	5	8	2.31	0.16
SHEQ Engineering	5.59 3.4	6.87 3.44	5	8	2.31	0.27

Table 4.3. indicates that there was no significant difference ($p > 0.05$) on the level of awareness of environmental goals and targets between SHEQ and the other departments.

Table 4.3. *t* Tests analysis on environmental goals and targets.

	Mean	SD	Observations	Degrees of Freedom	t Critical two-tail	*p* value (1 tail)
SHEQ	5.62	6.52	5	8	2.31	0.38
Production	4.40	5.32				
SHEQ	5.62	6.52	5	8	2.31	0.06
Procurement	0.4	0.89				
SHEQ	5.62	6.52	5	8	2.31	0.14
Logistics	2	2.35				
SHEQ	5.62	6.52	5	8	2.31	0.23
Engineering	3.2	2.39				

Table 4.4. indicates that the awareness of green designing initiative was not significantly different between the SHEQ and the other departments ($p > 0.05$), except for the procurement department ($p = 0.03$).

Table 4.4. *t* Tests analysis green designing initiatives

	Mean	SD	Observations	Degrees of Freedom	t Critical two-tail	*p* value (1 tail)
SHEQ	5.53	5.47	5	8	2.31	0.35
Production	4.40	3.19				
SHEQ	5.53	5.47	5	8	2.31	0.03
Procurement	0.4	0.43				
SHEQ	5.53	5.47	5	8	2.31	0.09
Logistics	1.87	1.22				
SHEQ	5.53	5.47	5	8	2.31	0.24
Engineering	3.4	3.34				

4.6 Conclusion

In this chapter, the research findings in terms of results, interpretation and discussion were outlined. The analysis was completed and explained using frequencies, percentages, column-charts, pie-charts, means, t tests, correlations and the Kruskal-Wallis Rank Test.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1. Introduction

This chapter outlines the conclusion and recommendations of the research. The section summarises the conclusions on the findings of the survey making analysis of employee perceptions towards green supply chain management in Gauteng starch and glucose processing industries. It also indicates the summary on research objectives and questions, recommendations for future research and conclusion. Furthermore, this section is aimed at revealing how the main purpose and the four study sub-objectives of this dissertation have been met.

5.2. Research findings

5.2.1. Findings on the main purpose of the study

Main purpose of the study: To make analysis of the perceptions of employees in the starch and glucose processing industry towards GSCM practices implemented in their organisations to address environmental sustainability, and the level of involvement and awareness of the employees on these initiatives.

Firstly, this study has revealed what GSCM practices have been implemented in GP food industry as perceived by employees. The research established that most employees in the GP starch and glucose manufacturing companies were aware of the GSCM initiatives adopted to address environmental sustainability. This was indicated in Chapter 4, where, on average, most employees answered “yes, fully”, a few answered “partially” and some answered “no, not at all” on the questionnaire.

Employees were aware that green manufacturing initiatives were fully implemented, whereas green designing, green procurement, green marketing, green distribution and reverse logistics were partially implemented. Very few employees indicated they were not sure of the implementation of these practices. This illustrated that the starch and glucose processing industry has been successful in implementing GSCM initiatives and has made employees in various departments aware of such endeavours.

5.2.2. Environmental management systems, policies, legislation and standards

Sub-objective 1: To evaluate the level of employee awareness of environmental policies, legislation, standards, environmental goals and targets, and green designing initiatives implemented.

The survey revealed the following about employee awareness and training on environmental management systems, policies, legislation and standards.

Most employees were aware that their companies had implemented environmental sustainability policies and environmental sustainability systems that were in accordance with legislation and ISO 14001, as indicated in 4.4.2. These results also indicated that top management of GP starch and glucose- processing companies have committed to environmental sustainability because they have increased their focus on the environment by improving environmental policies. Top management has also committed dedicated resources to manage sustainability issues in the form of a sustainability or SHEQ manager.

These environmental policies, initiatives, and expectations are communicated to suppliers, employees and contractors. Most employees also indicated their companies published sustainability reports that can be accessed by all employees, consumers and relevant stakeholders, which indicated the companies had integrated climate change strategies.

It was indicated by most employees that their companies had implemented systems to assess environmental aspects and impacts associated with their operations. As required

by relevant standards and statutory regulations, most employees indicated that companies had implemented pollution prevention strategies to green their activities. They had the necessary licenses or permits to use or store hazardous materials, wastewater management or air emissions. Employees were trained on handling hazardous substances, air emissions, effluent management, water use, hazardous waste management, preventing soil contamination, preventing ground water pollution and managing energy. Monitoring of energy usage, water usage, hazardous waste disposal, and treatment were done.

A considerable number of employees indicated their companies had systems in place to decrease the environmental impact of energy consumption and greenhouse gas emissions. They monitored air emissions such as N0x, SO2, mercury, and other hazardous air pollutants periodically.

However, many employees were not aware that greenhouse gas emissions and climate change strategies were reported annually to the Carbon Disclosure Project (CDP). This important factor must be communicated to employees to raise awareness on how their activities affect climate change. The impact, progress and return on sustainability programmes is not always consistently communicated to employees, consumers and all relevant stakeholders. Consistent communication is important to ensure success and improvement of GSCM practices.

Starch and glucose processing companies in GP have not fully “greened” their procurement processes. This was indicated by a considerable number of employees showing that policy for green procurement of products for their internal use has been partially implemented. A small number of employees indicated that their companies are fully addressing environmental impacts derived from product transportation. Therefore, most companies have not greened their supply chains post-dispatch. A recommendation would be for companies to measure and reduce environmental impact derived from product transportation.

5.2.3. Environmental goals and targets

The study revealed the following regarding food companies' environmental goals and targets.

Most employees indicated in 4.4.3. that their companies had put in place environmental targets and objectives aimed at enhancing environmental performance; they review environmental performance periodically through management reviews. These are requirements for ISO 14001. Most had set goals and targets to reduce energy consumption; they had targets in place to reduce water usage, reuse or recycle water.

The study also revealed that a few companies have targets for reverse logistics. Greening of activities post-use at the product's end-of-life have been partially implemented, as a considerable number of employees indicated that targets for reduction disposal of waste to landfill, elimination and/or recycling of waste were partially in place. Hence, a slight decrease in waste disposed to landfill by sorting and recycling waste was noted. Food manufacturers can adopt targets for minimising waste by remanufacturing, recycling, reusing or redistribution.

5.2.4. Green designing initiatives

The study showed in 4.4.4, that according to employees, green designing initiatives had been implemented on a very small scale in the GP food companies. Most employees indicated their companies had not greened the design of buildings and facilities, a considerable number indicated their companies had partially improved energy efficiency by installing energy efficient equipment, whilst a significant number stated their companies have not improved energy efficiency by monitoring and reducing water usage.

5.2.5. Partnerships with suppliers, contractors and the government

Sub-objective 2: To assess the perceptions of the employees towards GSCM partnerships that their companies have implemented with suppliers, contractors, including the government.

The study revealed the following about company partnerships with suppliers, contractors and the government in 4.4.5.

A significant number of employees indicated their companies demanded and/or collaborated with suppliers on reducing the environmental impacts of their activities and products; others indicated this was partially done. Most of employees indicated their companies required their suppliers to meet all relevant regulatory requirements and international environmental management standards, such as ISO 14001.

Some suppliers used were approved based on environmental questionnaires, environmental audits and assessments or environmental criteria. Most employees indicated their companies audited their waste management suppliers and the waste management contractors had relevant certifications and permits.

A few employees however indicated their companies were partially in partnership with the government and/or consumers when it came to making progress on environmental sustainability issues. However, the supplier-buyer partnerships that have been demonstrated in the GP food manufacturers are a step closer to the success of GSCM in this industry.

5.2.6. Green marketing campaigns and competitive advantage

Sub-objective 3: To evaluate if the employees recognise the benefits of green marketing campaigns and GSCM initiatives within their companies.

The study revealed the following about green marketing campaigns and competitive advantage in 4.4.6.

Most of the employees indicated that their companies had not introduced award schemes for them to acknowledge and encourage their positive actions towards sustainability or maintaining a ‘green’ culture. A considerable number of employees indicated their company products had not been eco-branded, nor have their companies launched advertising and marketing campaigns to promote sales of green products.

A significant number of employees indicated they were not sure if their companies had identified an advantage over their competitors, or seen an increase in profitability and savings during purchasing and production since the implementation of GSCM initiatives. Communication of financial benefits to GSCM could be improved to enhance buy-in from relevant stakeholders.

5.2.7. Barriers that hinder the effective implementation

Sub-objective 4: To identify barriers hindering the effectiveness of GSCM implementation.

In 4.4.4, a significant number of employees in food companies indicated that resistance to change and lack of technology advancement adoption were partial hindrances to implementing and maintaining an effective "green culture." In this regard, improved communication, training and education would assist their companies to achieve successful GSCM implementation, as indicated by most employees.

This improvement could be driven from a top management level, as they could demonstrate commitment to GSCM strategies by motivating employees through subjecting them to regular communication, training and education.

A considerable number of employees indicated they were not sure if government support systems were sufficient to assist their companies in implementing efficient GSCM initiatives. Some mentined that government support systems were not sufficient.

Cost implications were indicated as a major barrier to implementing efficient GSCM initiatives by a considerable number of employees.

5.2.8. Statistical Analysis

The assumptions above can be accepted as indicated in the statistical analysis. In Annexure 3, the Kruskal-Wallis Rank Test indicated no significant differences ($p > 0.05$) in the scoring tendencies between the SHEQ, production, procurement, logistics and engineering employees' answers in the survey questionnaire, except for question 36 where p-value is <0.05. Denoting that the assumption that there is a significant decrease in waste disposed to landfill by sorting and recycling waste cannot be accepted. Meanwhile, the *t*-test results in section 4.4.2 indicated that the level of awareness of environmental management systems, policies, legislation, standards, goals, targets and green designing between SHEQ and the other departments was not significantly different ($p > 0.05$). However, the assumption on the awareness of green designing between SHEQ and the procurement department cannot be accepted ($p = 0.03$ on *t*-test).

5.3. Recommendations for future research

As this study was based on only five food companies, future research should consider other food manufacturers in the Gauteng province, with larger sample sizes. The survey research can still be utilised, however more robust follow-up must be done for more companies' approval of the research for a larger sample size and for increased response rate.

The concept of greening of supply chains is fairly well known and applied in the food manufacturing industry, however this study has been based on employee perceptions towards GSCM initiatives implemented. It is recommended that more studies be conducted to assess how GSCM has been applied in food manufacturing companies supply chains in the South African context. There are many strategies that organisations can implement, and they can reap considerable financial benefits from GSCM.

It would be beneficial to discover if there are food manufacturing companies who have reaped significant financial benefits from greening their businesses. This would indicate if there were tangible benefits seen by food manufacturers who have invested in implementing green supply chain management strategies in full. It would also show what innovations and employee reward schemes have been considered and how it has changed the attitude of organisations positively towards GSCM. Lastly, more studies can be done to indicate how companies who have implemented a systematic “closed-loop oriented” approach to GSCM have improved environmental performance, financial performance and competitive advantage.

5.4. Conclusion

This is the last chapter of the study and it outlined the discussion of the research findings, the summary of research objectives and questions, and recommendations for future research. With regards to the first sub-objective of the study it was found that employees in starch and glucose processing companies situated in the Gauteng province in SA were aware of the implemented environmental policies, legislation, standards, environmental goals and targets, and green designing initiatives. Most employees were trained and involved in these initiatives as outlined in sections 5.2.2 to 5.2.4. Section 5.2.5 indicated how the second sub-objective of the research was met by highlighting that most employees perceived their companies to have collaborated with suppliers and contractors in terms of environmental management. However, the employees also perceived that government partnerships were not sufficient and therefore could be a barrier to successful GSCM implementation.

The third sub-objective was achieved as well. Section 5.2.5 outlined that a considerable number of employees have not identified the benefits of green marketing campaigns and GSCM initiatives. The last sub-objective was achieved by the research revealing in section 5.2.7 that resistance to change and technology advancement adoption, insufficient communication, training and education, and cost implications, were partially hindering GSCM success in this industry. Initiatives listed in sub-objectives one to three of this study make up a closed-loop approach to GSCM implementation, hence it is important to indicate that the starch and glucose processing industry has not implemented a systematic “closed-loop oriented” approach to GSCM, as perceived by employees.

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ANNEXURES

Annexure 1 Online survey questionnaire

Green Supply Chain Management Questionnaire

This study is conducted to evaluate the state of Green Supply Chain Management in the Gauteng Food Manufacturing Industry and determine its perspective thereof. Respondents should be individuals working in supervisory/management positions in the procurement, logistics, processing/production, engineering/maintenance and Safety, Health, Environment and Quality (SHEQ) departments in food manufacturing companies in Gauteng province, South Africa. Participants in the survey are doing it freely without being forced in anyway. Participants can stop completing the questionnaire at any time and withdraw from the research without it affecting them negatively in any way.

The names and the companies of the individuals completing this questionnaire will not be disclosed for confidentiality purposes. Answers will remain entirely confidential.
The final report that will be produced from this survey will be a public document and responses will be combined with those of other respondents.

Any questions about the study can be directed to antoinette.sithole@gmail.com.

Please choose an option below to give consent before completing the questionnaire:

☐ I agree with the above and would like to give consent to complete the questionnaire
☐ I do not agree with the above and would like to withdraw from the survey.

What is the position in your organisation?

☐Production/Operations/Processing Supervisor/Manager
☐SHEQ/SHE/QA Supervisor/Manager
☐Engineering/Maintenance Supervisor/manager
☐Procurement Supervisor/Manager
☐Materials/Logistics Supervisor/Manager

Type of product manufactured (food, beverage, dairy, snacks etc.):	
Province where your organisation is situated?	

	Yes, Fully	**Partially**	**No, not at all**	**I am not sure**	**Not Applicable**
Question	☐	☐	☐	☐	☐
1. Does the organisation have a Sustainability or SHEQ manager or equivalent?	☐	☐	☐	☐	☐
2. Does the organisation have a system for establishing sustainability standards in its supply chain?	☐	☐	☐	☐	☐
3. Does the organisation have a sustainability/SHEQ policy endorsed by the board or top management?	☐	☐	☐	☐	☐
4. Does the organisation have a policy for green procurement of products for their internal use, e.g. paper, IT equipment, cleaning products?	☐	☐	☐	☐	☐
5. Does the organisation demand and/or collaborate with suppliers on reducing the environmental impacts of their activities and products; sourcing products with lower environmental impacts (e.g. local and organic)?	☐	☐	☐	☐	☐
6. Are suppliers used by the organisation required to meet all relevant regulatory requirements and international environmental management standards, such as ISO 14001?	☐	☐	☐	☐	☐
7. Are suppliers approved based on Environmental Questionnaires, Environmental Audits and Assessments or Environmental Criteria?	☐	☐	☐	☐	☐
8. Does the organisation publish a Sustainability Report that can be accessed by all employees, consumers and all relevant stakeholders?	☐	☐	☐	☐	☐

9. Does the organisation keep up-to-date with environmental legislation changes and train suppliers in environmentally relevant process changes?	☐	☐	☐	☐	☐
10. Does the organisation have a management system in place to assess environmental aspects and impacts associated with operations?	☐	☐	☐	☐	☐
11. Is the organisation's management system in compliance with compliance with relevant environmental legislation?	☐	☐	☐	☐	☐
12. Does the organisation have valid environmental certification such as ISO 14001?	☐	☐	☐	☐	☐
13. Does the organisation have the necessary license(s) or permit(s) for use or storage of hazardous substances, effluent, management or air emissions?	☐	☐	☐	☐	☐
14. Are environmental policies, initiatives, and expectations communicated to suppliers, employees and contractors?	☐	☐	☐	☐	☐
15. Are employees trained on environmental management issues, such as handling of hazardous substances, air emissions, effluent management, water use, hazardous waste management, preventing soil and groundwater pollution and energy management?	☐	☐	☐	☐	☐
16. Has the organisation introduced award schemes for employees to acknowledge and encourage their positive actions towards sustainability/maintaining a 'green' culture?	☐	☐	☐	☐	☐
17. Has the organisation put in place environmental targets and objectives aimed at enhancing environmental performance?	☐	☐	☐	☐	☐
18. Does the organisation review environmental performance periodically through management reviews?	☐	☐	☐	☐	☐

19. Does the organisation monitor energy usage and conduct energy audits as required by applicable standards and legislation?	☐	☐	☐	☐	☐
20. Does the organisation have measures in place to decrease the environmental impact of energy consumption and greenhouse gas emissions?	☐	☐	☐	☐	☐
21. Does the organisation have set goals and targets to reduce energy consumption?	☐	☐	☐	☐	☐
22. Does the organisation report greenhouse gas emissions and climate change strategy to the Carbon Disclosure Project (CDP) annually?	☐	☐	☐	☐	☐
23. Does the organisation monitor air emissions, such as N0x, SO2, mercury, and other hazardous air pollutants periodically?	☐	☐	☐	☐	☐
24. Does the organisation have a system in place to periodically manage and monitor water usage?	☐	☐	☐	☐	☐
25. Does the organisation have a system in place to reduce water usage, reuse or recycle water? Targets in place?	☐	☐	☐	☐	☐
26. Does the organisation treat effluent prior to off-site discharge?	☐	☐	☐	☐	☐
27. Is there a waste reduction, elimination and/or recycling program in place? Targets in place?	☐	☐	☐	☐	☐
28. Does the organisation have a system to handle and dispose of hazardous waste?	☐	☐	☐	☐	☐
29. Does the organisation keep records of waste disposal and treatment?	☐	☐	☐	☐	☐
30. Does the organisation audit its waste management contractors?	☐	☐	☐	☐	☐

31. Do waste management contractors have relevant certifications and permits?	☐	☐	☐	☐	☐
32. Is the organisation addressing environmental impacts derived from product transportation, e.g. optimising transportation efficiency, switching towards less polluting transportation modes, reusing/decreasing transportation packaging, etc.?	☐	☐	☐	☐	☐
33. Has the organisation “greened” the design of building and facilities, e.g. installed technical hardware, such as heat pumps, solar panels and wind turbines, to save energy or generate own green electricity?	☐	☐	☐	☐	☐
34. Has the organisation improved energy efficiency by installing energy efficient bulbs, moving detection systems for lighting, hinged doors for refrigerated space and heat recovery systems in cold production facilities, sourcing renewable energy, etc.?	☐	☐	☐	☐	☐
35. Has the organisation improved energy efficiency by monitoring and reduction water usage (installed tap water dimmers, urinal control systems, etc.)?	☐	☐	☐	☐	☐
36. Has the organisation seen a significant decrease in waste disposed to landfill by sorting and recycling waste?	☐	☐	☐	☐	☐
37. Is the organisation in partnership with the government and/or consumers when it comes to making progress on environmental sustainability issues?	☐	☐	☐	☐	☐
38. Do products manufactured at your organisation have environmental labels (eco-branded)?	☐	☐	☐	☐	☐
39. Has the organisation launched advertising and marketing campaigns to promote sales of green products?	☐	☐	☐	☐	☐
40. Has the organisation been able to identify an advantage over their competitors and shown an increase in profitability and savings during purchasing and	☐	☐	☐	☐	☐

production since the implementation of Green Supply Chain initiatives?					
41. Are impact, progress and return of sustainability programmes consistently communicated to employees, consumers and all relevant stakeholders?	☐	☐	☐	☐	☐
42. Do you find that resistance to change and technology advancement adoption are hindrances to implementing and maintaining an effective "green culture" in your organisation?	☐	☐	☐	☐	☐
43. Do you feel that improved communication, training and education would help your organisation in achieving successful Green Supply Chain Management implementation?	☐	☐	☐	☐	☐
44. Are government support systems sufficient to assist your organisation to implement efficient Green Supply Chain Management initiatives?	☐	☐	☐	☐	☐
45. Are cost implications a major barrier to implement efficient Green Supply Chain Management initiatives in your organisation?	☐	☐	☐	☐	☐

Thank you for completing the questionnaire.

Link to the online survey:

https://docs.google.com/forms/d/e/1FAIpQLSe9fPNekgBBs6zT1QYW9iLDq9GoVsX3KZr3MxJdhmH--l81TA/viewform?c=0&w=1&usp=mail_form_link

Annexure 2 Questionnaire design

Research objectives & sub-objectives	Research questions	Survey questions (Q)
To analyse the perceptions and practices of employees in the starch and glucose processing industry towards implementation of GSCM in their organisations to address environmental sustainability, and the level of involvement and awareness of these initiatives.	What are the perceptions of employees in the starch and glucose processing industry towards GSCM practices implemented in their organisations to address environmental sustainability, and the level of their involvement and awareness for the success of these initiatives?	All
To evaluate the level of employee awareness of environmental goals and targets, environmental policies, legislation and standards, and green designing initiatives implemented.	How are employees involved, trained and made aware of the environmental goals and targets, environmental policies, legislation and standards, and green designing initiatives implemented?	Q2, Q3, Q4, Q8, Q9, Q10 Q11, Q12, Q13, Q14, Q15, Q17, Q18, Q19, Q20, Q21, Q22, Q23, Q24, Q25, Q26, Q27, Q28, Q29, Q32, Q33, Q34, Q35, Q36, Q41
To assess the perceptions of the employees towards GSCM partnerships that their companies have implemented with	What are the perceptions of the employees towards company's environmental management partnerships with its suppliers,	Q5, Q6, Q7, Q30, Q31, Q37

suppliers, contractors, including the government.	contractors, including the government?	
To evaluate if the employees recognise the benefits of green marketing campaigns and GSCM initiatives within their companies.	What are the benefits employees have identified in green marketing campaigns and GSCM initiatives?	Q16, Q38, Q39, Q40
To identify barriers hindering the effectiveness of GSCM implementation.	What are the barriers that hinder the effective implementation of GSCM?	Q42, Q43, Q44, Q45

Annexure 3 The Kruskal-Wallis Rank Test for each response on the questionnaire

Question	p-value	Accept/Reject assumption
1. Does the organisation have a Sustainability or SHEQ manager or equivalent?	0.992	Accept
2. Does the organisation have a system for establishing sustainability standards in its supply chain?	0.721	Accept
3. Does the organisation have a sustainability/SHEQ policy endorsed by the board or top management?	0.977	Accept
4. Does the organisation have a policy for green procurement of products for their internal use, e.g. paper, IT equipment, cleaning products?	0.169	Accept
5. Does the organisation demand and/or collaborate with suppliers on reducing the environmental impacts of their activities and products; sourcing products with lower environmental impacts (e.g. local and organic)?	0.191	Accept
6. Are suppliers used by the organisation required to meet all relevant regulatory requirements and international environmental management standards such as ISO 14001?	0.323	Accept
7. Are suppliers approved based on Environmental Questionnaires, Environmental	0.153	Accept

Audits and Assessments or Environmental Criteria?		

Table 4.2 continued

Question	**p-value**	**Accept/Reject assumption**
8. Does the organisation publish a Sustainability Report that can be accessed by all employees, consumers and all relevant stakeholders?	0.259	Accept
9. Does the organisation keep up-to-date with environmental legislation changes and train suppliers in environmentally relevant process changes?	0.281	Accept
10. Does the organisation have a management system in place to assess environmental aspects and impacts associated with operations?	0.952	Accept
11. Is the organisation's management system in compliance with compliance with relevant environmental legislation?	0.791	Accept
12. Does the organisation have valid environmental certification such as ISO 14001?	0.848	Accept
13. Does the organisation have the necessary license(s) or permit(s) for use or storage of hazardous substances, effluent, management or air emissions?	0.787	Accept

14. Are environmental policies, initiatives, and expectations communicated to suppliers, employees and contractors?	0.661	Accept

Table 4.2 continued

Question	**p-value**	**Accept/Reject assumption**
15. Are employees trained on environmental management issues such as handling of hazardous substances, air emissions, effluent management, water use, hazardous waste management, preventing soil and groundwater pollution and energy management?	0.624	Accept
16. Has the organisation introduced award schemes for employees to acknowledge and encourage their positive actions towards sustainability/maintaining a ‘green’ culture?	0.506	Accept
17. Has the organisation put in place environmental targets and objectives aimed at enhancing environmental performance?	0.404	Accept
18. Does the organisation review environmental performance periodically through management reviews?	0.415	Accept
19. Does the organisation monitor energy usage and conduct energy audits as required by applicable standards and legislation?	0.461	Accept

20. Does the organisation have measures in place to decrease the environmental impact of energy consumption and greenhouse gas emissions?	0.208	Accept
21. Does the organisation have set goals and targets to reduce energy consumption?	0.444	Accept

Table 4.2 continued

Question	**p-value**	**Accept/Reject assumption**
22. Does the organisation report greenhouse gas emissions and climate change strategy to the Carbon Disclosure Project (CDP) annually?	0.263	Accept
23. Does the organisation monitor air emissions such as N0x, SO2, mercury, and other hazardous air pollutants periodically?	0.192	Accept
24. Does the organisation have a system in place to periodically manage and monitor water usage?	0.781	Accept
25. Does the organisation have a system in place to reduce water usage, reuse or recycle water? Targets in place?	0.411	Accept
26. Does the organisation treat effluent prior to off-site discharge?	0.381	Accept
27. Is there a waste reduction, elimination and/or recycling programme in place? Targets in place?	0.555	Accept

28. Does the organisation have a system to handle and dispose of hazardous waste?	0.660	Accept
29. Does the organisation keep records of waste disposal and treatment?	0.689	Accept

Question	**p-value**	**Accept/Reject assumption**

Table 4.2 continued

Question	**p-value**	**Accept/Reject assumption**
30. Does the organisation audit its waste management contractors?	0.214	Accept
31. Do waste management contractors have relevant certifications and permits?	0.922	Accept
32. Is the organisation addressing environmental impacts derived from product transportation, e.g. optimising transportation efficiency, switching towards less polluting transportation modes, reusing/decreasing transportation packaging etc.?	0.080	Accept
33. Has the organisation “greened” the design of building and facilities, e.g. installed technical hardware such as heat pumps, solar panels and wind turbines to save energy or generate own green electricity?	0.129	Accept
34. Has the organisation improved energy efficiency by installing energy efficient bulbs,	0.154	Accept

moving detection systems for lighting, hinged doors for refrigerated space and heat recovery systems in cold production facilities, sourcing renewable energy, etc.?		
35. Has the organisation improved energy efficiency by monitoring and reduction water usage (installed tap water dimmers, urinal control systems etc.)?	0.239	Accept
36. Has the organisation seen a significant decrease in waste disposed to landfill by sorting and recycling waste?	0.039	Reject
37. Is the organisation in partnership with the government and/or consumers when it comes to making progress on environmental sustainability issues?	0.095	Accept
38. Do products manufactured at your organisation have environmental labels (eco-branded)?	0.073	Accept
39. Has the organisation launched advertising and marketing campaigns to promote sales of green products?	0.101	Accept
40. Has the organisation been able to identify an advantage over their competitors and shown an increase in profitability and savings during purchasing and production since the	0.100	Accept

implementation of Green Supply Chain initiatives?		
41. Are impact, progress and return of sustainability programmes consistently communicated to employees, consumers and all relevant stakeholders?	0.094	Accept
42. Do you find that resistance to change and technology advancement adoption are hindrances to implementing and maintaining an effective "green culture" in your organisation?	0.087	Accept
43. Do you feel that improved communication, training and education would help your organisation in achieving successful Green Supply Chain Management implementation?	0.943	Accept
44. Are government support systems sufficient to assist your organisation to implement efficient Green Supply Chain Management initiatives?	0.256	Accept
45. Are cost implications a major barrier to implement efficient Green Supply Chain Management initiatives in your organisation?	0.210	Accept

Annexure 5 Correlations in GSCM awareness between departments

	GSCM Awareness	Partnerships	Benefits
GSCM Awareness	1.00		
Partnerships	0.93	1.00	
Benefits of GSCM	0.05	-0.10	1

Then, the correlation function in MS Excel was used to generate a correlation matrix showing the Pearson correlation coefficient (r) for the relationships between the awareness of GCSM, GSCM partnerships and benefits of GSCM.

Annexure 5 indicates that there is a strong positive correlation between GSCM awareness and GSCM partnerships (r = 0.93). However, a weak positive correlation exists between GSCM awareness and benefits of GSCM (r = 0.05), and a weak negative correlation between partnerships and benefits of GSCM (r = - 0.10). However, these correlation results have no significance to the objectives of the study.

Annexure 4 Ethics Approval

UNISA university of south africa

CAES RESEARCH ETHICS REVIEW COMMITTEE

Date: 05/03/2015

Ref #: **2015/CAES/033**
Name of applicant: **Ms KA Sithole**
Student #: **41894596**

Dear Ms Sithole,

Decision: Ethics Approval

Proposal: An analysis of the state of green supply chain management in the Gauteng food manufacturing industry

Supervisor: Mrs U Van den Berg

Qualification: Postgraduate degree

Thank you for the application for research ethics clearance by the CAES Research Ethics Review Committee for the above mentioned research. Final approval is granted for the duration of the project, **subject to submission of the permission letters from the individual companies targeted in the study.**

Please consider point 4 below for further action.

The application was reviewed in compliance with the Unisa Policy on Research Ethics by the CAES Research Ethics Review Committee on 05 March 2015.

The proposed research may now commence with the proviso that:

1) *The researcher/s will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.*
2) *Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study, as well as changes in the methodology, should be communicated in writing to the CAES Research Ethics Review Committee. An amended application could be requested if there are substantial changes from the existing proposal, especially if those changes affect any of the study-related risks for the research participants.*

University of South Africa
Preller Street, Muckleneuk Ridge, City of Tshwane
PO Box 392 UNISA 0003 South Africa
Telephone: +27 12 429 3111 Facsimile: +27 12 429 4150
www.unisa.ac.za

3) *The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study.*

4) *The researcher must obtain written permission from each company before their employees may be approached. These letters must be submitted to the Committee as they are obtained.*

Note:

The reference number [top right corner of this communiqué] should be clearly indicated on all forms of communication [e.g. Webmail, E-mail messages, letters] with the intended research participants, as well as with the CAES RERC.

Kind regards,

Signature

CAES RERC Chair: Prof EL Kempen

Signature

CAES Executive Dean: Prof MJ Linington

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Annexure 5 Company permission letter

CONSENT FORM

TITLE OF RESEARCH PROJECT

EMPLOYEE PERCEPTIONS TOWARDS GREEN SUPPLY CHAIN MANAGEMENT IN GAUTENG STARCH AND GLUCOSE PROCESSING INDUSTRIES

Dear Mr/Mrs/Miss/Ms _____ Date...../...../20...

NATURE AND PURPOSE OF THE STUDY

This study is conducted to evaluate the current state of Green Supply Chain Management (GSCM) in the Gauteng Food Manufacturing Industry and to provide the perspective of the industry towards GSCM. Furthermore, this research intends to demonstrate the role played by the industry in maintaining environmental sustainability. It also intends to identify the challenges faced by these companies in maintaining a “green” culture and to identify opportunities for improving their Green Supply Chain Management initiatives.

RESEARCH PROCESS

1. 150 voluntary participants working in management/supervisory positions in food manufacturing companies in the Gauteng Province of South Africa will complete an online survey that will take 10-20 minutes.
2. The questionnaire will include questions about environmental management and sustainability.
3. Statistical analysis will be used to analyse the data from the completed surveys/questionnaires, conclusions will be drawn and a report will be produced.

NOTIFICATION THAT PHOTOGRAPHIC MATERIAL, TAPE RECORDINGS, ETC WILL BE REQUIRED.

No photographic, tape recording or any other form of recording will be required for this research.

CONFIDENTIALITY

Responses to surveys/questionnaires will be kept entirely confidential. The names of the respondents and companies involved in the survey will not be disclosed.

WITHDRAWAL CLAUSE

Participants in the survey are doing it freely without being forced in anyway. Participants can stop completing the questionnaire at any time and withdraw from the research without it affecting them negatively in any way.

POTENTIAL BENEFITS OF THE STUDY

The benefits of the study will be to give an indication on the current state and perspective of GSCM in the Gauteng food manufacturing industry. It will also provide information on the contribution made by the food manufacturing industry in Gauteng to address environmental sustainability issues and will identify opportunities for improvement in Green Supply Chain Management initiatives.

INFORMATION (contact information of your supervisor).

Name: Mrs Unine van den Berg

Contact number: 011 471 3093

Email address: vdberu@unisa.ac.za

CONSENT

I, the undersigned, …….… (full name) have read the above information relating to the project and have also heard the verbal version, and declare that I understand it. I have been afforded the opportunity to discuss relevant aspects of the project with the project leader, and hereby declare that I agree voluntarily to participate in the project.

I indemnify the university and any employee or student of the university against any liability that I may incur during the course of the project.

I further undertake to make no claim against the university in respect of damages to my person or reputation that may be incurred as a result of the project/trial or through the fault of other participants, unless resulting from negligence on the part of the university, its employees or students.

I have received a signed copy of this consent form.

Signature of participant: .....

Signed at …… on ……

WITNESSES

1 .....

2 .....